

THE GENUS *COSTATRICHIA* MOSELY IN COSTA RICA, WITH A REVIEW
OF THE NEOTROPICAL SPECIES (TRICHOPTERA: HYDROPTILIDAE)

RALPH W. HOLZENTHAL AND STEVEN C. HARRIS

(RWH) Department of Entomology, University of Minnesota, St. Paul, MN 55108, U.S.A. (e-mail: holze001@tc.umn.edu); (SCH) Department of Biology, Clarion University, Clarion, PA 16214, U.S.A. (e-mail: harris@mail.clarion.edu)

Abstract.—Three new species of *Costatrichia* (Trichoptera: Hydroptilidae) are described from Costa Rica, *C. carara*, *C. flinti*, and *C. zopilote*, and one from Venezuela, *C. cressae*. The subspecies *Costatrichia tripartita venezuelensis* from Venezuela is elevated to species status and newly recorded from Costa Rica. Illustrations and a key to males of the 12 known species in the genus are provided. The females of *C. carara*, *C. simplex*, *C. tripartita*, and *C. zopilote* are illustrated.

Key Words: Trichoptera, Costa Rica, Venezuela, taxonomy, microcaddisflies, Neotropics, key

This paper on the genus *Costatrichia* Mosely represents another in a continuing series of works emphasizing the taxonomy of the microcaddisfly fauna of Costa Rica. In cases where a broader review of the fauna is necessary to resolve taxonomic problems, we have expanded our study beyond Costa Rica, as we have done in this paper. We herein describe four new species, including one from Venezuela, redescribe another four species known from Costa Rica, elevate one subspecies to full species status, and illustrate two species not reported from, but likely to occur in Costa Rica. As well, we have included new figures of *C. noite* Angrisano since we have seen additional material from Peru [Loreto: Sucusari River at Explornapo Camp, 13 January 1993, L. J. Davenport (NMNH, UMSP)], suggesting a wider range for the species than previously suspected. A key is included to separate the males of all known species in the genus.

The genus *Costatrichia* was erected by Mosely in 1937 for *C. lodora* from Chia-

pas, Mexico. Since then, six additional species have been described, including *C. bipartita* Flint 1970 (Nicaragua), *C. noite* Angrisano 1995 (Uruguay), *C. panamensis* Flint 1967 (Panama), *C. simplex* Flint 1970 (Costa Rica, El Salvador, Honduras, Mexico, Nicaragua), *C. spinifera* Flint 1970 (Panama), and *C. tripartita* Flint 1970 (Panama). In addition, Flint (1981) also described the subspecies *C. tripartita venezuelensis* from Venezuela. Flint (1970) recorded *C. lodora* and *C. simplex* from Costa Rica. Another of these species, *C. spinifera* Flint from Panama, is herein recorded from Costa Rica. With the description of four new Costa Rican and Venezuelan species in this paper and the elevation of the subspecies to full specific status, 12 species are now known in the genus. The immature stages of *Costatrichia* are unknown and nothing of substance is known about the biology of the genus except that adults are usually taken near flowing water.

Flint (1970) separated the genus into two groups based on features of the male geni-

talia, head and wings. The *simplex* group contained those males with unmodified antennae, and no basal costal bulla in the forewing, while the *lodora* group contained those species with modified antennae, a costal bulla, and divided inferior appendages. Flint (1970) mentioned the close similarity among *Costatrichia*, *Leucotrichia*, and *Zumatrichia*, with greater similarity to the latter genus. In Marshall's (1979) key the *lodora* group keyed close to *Acostatrichia* Mosely and the *simplex* group keyed separately with *Betrichia argentinica* Flint, *Leucotrichia malleopicta* group, and *Celaenotrichia* Mosely. It may be, however, that *Costatrichia* is paraphyletic, with the *simplex* group belonging to another genus. Costal bullae and modified male antennae occur in other genera within the Leucotrichiini. As mentioned by Marshall (1979) and Flint (1992), the generic limits of those taxa placed in the Leucotrichiini, including *Costatrichia*, are not clearly defined. Only a reassessment of all genera in the tribe will resolve the taxonomic problems. We have recently finished a review of the Stactobiini which necessitated an examination of the Leucotrichiini. A complete reassessment of the Leucotrichiini is beyond the scope of this paper, but we are pursuing these studies. In anticipation of this larger assessment and for ongoing research in biodiversity conservation and aquatic ecology, we take this opportunity to provide names for these new species now. However, until the larger assessment of the leucotrichiine genera and their characters occurs, the exact placement or status of the genus *Costatrichia* remains in question.

Types of species described in this paper are deposited in the collections of the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (NMNH), the University of Minnesota Insect Collection, St. Paul, Minnesota (UMSP), the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania (CMNH), the Universidad Central de Venezuela, Maracay (UCV), and the Instituto Nacional de

Biodiversidad, Santo Domingo, Heredia, Costa Rica (INBIO) as noted in the descriptions. Morphological descriptions follow the terminology of Marshall (1979). Specimen length is measured from the tip of the wings to the top of the head and is given as a range when more than one specimen was measured.

Costatrichia Mosely

Costatrichia Mosely 1937: 166 [Type species: *Costatrichia lodora* Mosely 1937, original designation].—Flint 1970:11 [revision].

Costatrichia is defined by the following characteristics: Head unmodified in males and females; 3 ocelli in males and females, antenna with scape elongate in most males, otherwise basal segments unmodified, remaining segments terete, or with middle segments broad in males of some species; males usually with costal bulla on forewing, comprised of short thickened setae, varying in length; transverse suture on mesoscutellum, metascutellum subpentagonal to triangular in shape; tibial spur formula 1,3,4. Generally brown in coloration with greenish bands or patches of hairs on the forewing. Male genitalia with abdominal segment VII bearing elongate sternal process; segment VIII typically narrowing ventrolaterally; segment IX greatly reduced ventrally, often bearing elongate lateral process and with setose lateral process; segment X short and membranous, partly fused with IX anteriorly. Inferior appendages elongate and conspicuous or absent; subgenital plate present or absent. Phallus with median complex, which includes a basal loop and dorsal window, anteriorly with spines or sclerites. Female genitalia with abdominal segment VII with short sternal process. Segment VIII usually with patches of short spicules. Bursa copulatrix with lyrelike vaginal sclerite bearing teeth on inner margin.

Costatrichia lodora Mosely

(Figs. 1A, 2A, 3, 4)

Costatrichia lodora Mosely 1937:168.

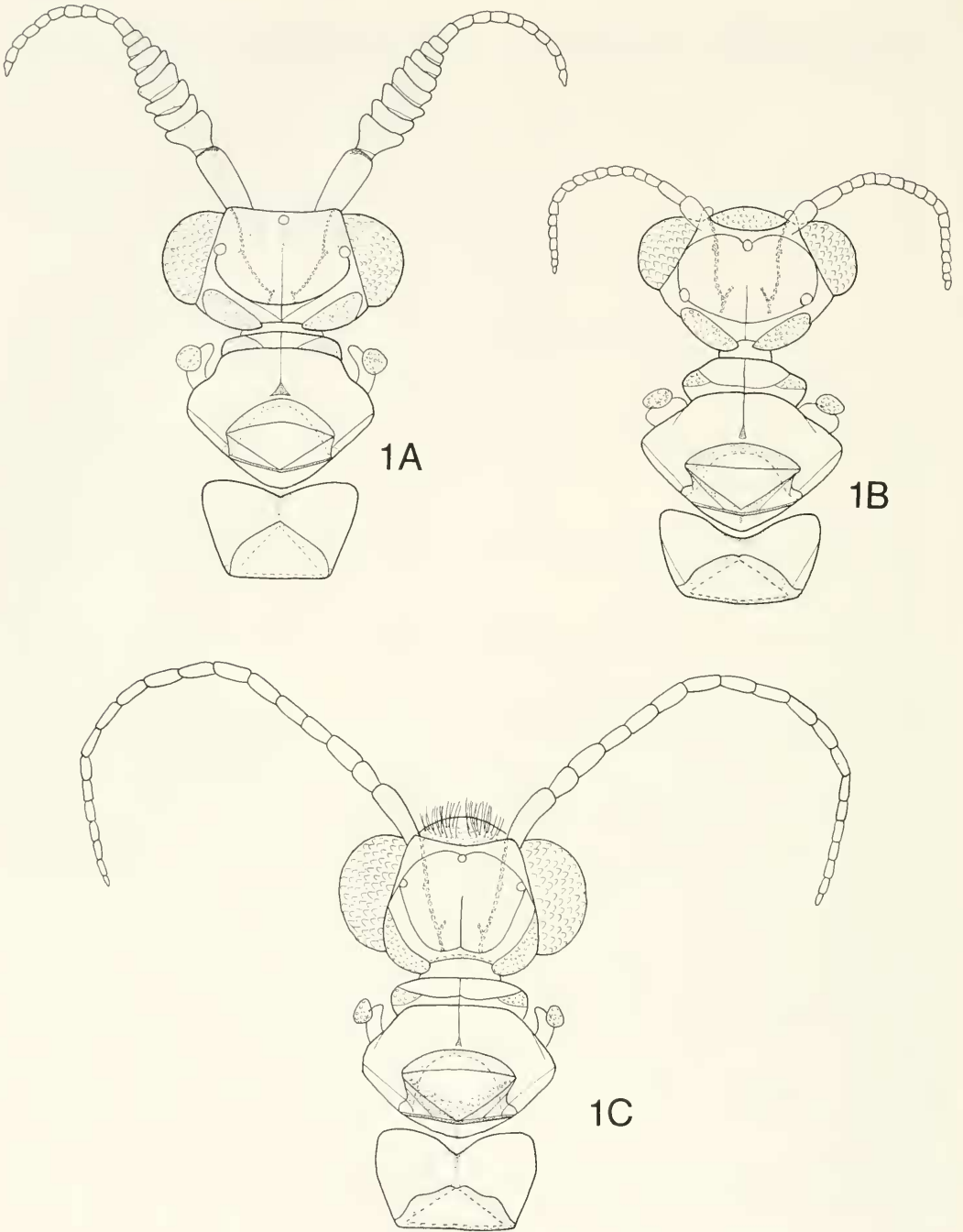
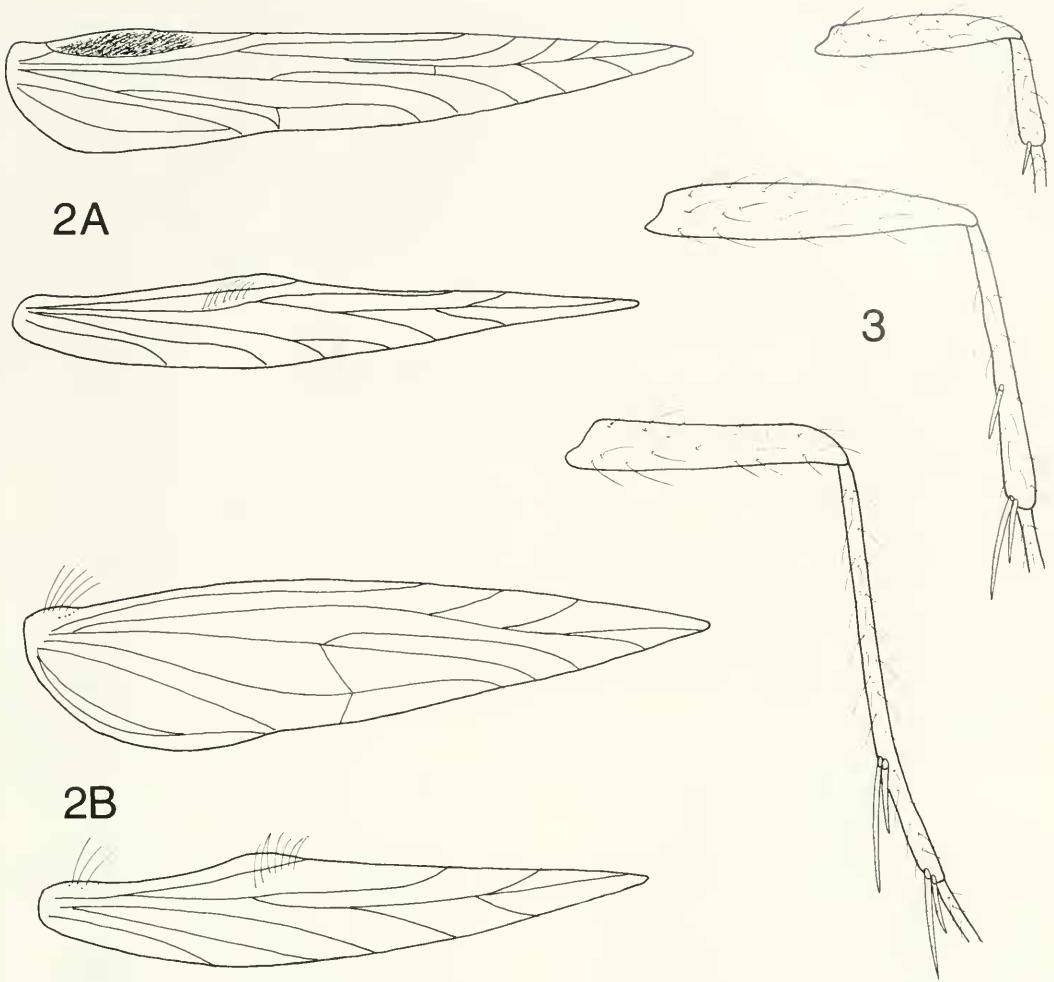


Fig. 1. Head and thorax of male *Costarichia*, dorsal view. A, *C. lodora*. B, *C. spinifera*. C, *C. zopilote*.



Figs. 2-3. 2, Fore and hind wings of *Costatrichia*. A, *C. lodora*. B, *C. zopilote*. 3, Fore, mid and hindlegs of *C. lodora*.

Costatrichia lodora is most similar to the following new species. Both are related to *C. pauamensis*, differing primarily in the shorter, more rounded posterior process from abdominal segment VIII.

Male.—Length 3.4–4.2 mm. Brown in alcohol. Antenna with 19 segments, scape elongate, basal flagellar segments broad; 3 ocelli. Forewing with elongate costal bulla. Abdominal sternum VII with elongate, slender process. Segment VIII narrowing posterolaterally to acute point; in ventral aspect with narrow posteromesal excision. Segment IX mostly within segment VIII,

narrowing anteriorly, posteriorly with small dorsal knob and elongate posteroventral process, dorsolaterally with short setose process; in dorsal view posteroventral process generally truncate, slightly emarginate posteriorly. Segment X membranous; in dorsal view, triangular posteriorly, broadly fused to segment IX anteriorly. Inferior appendages incised on posterior margin, dorsal arm thin and slightly narrowing posteriorly, ventral arm broadly rounded; in ventral view rectanguloid with apices curved slightly inward, thin lateral sclerotized processes sharply curved inward at apex. Phal-

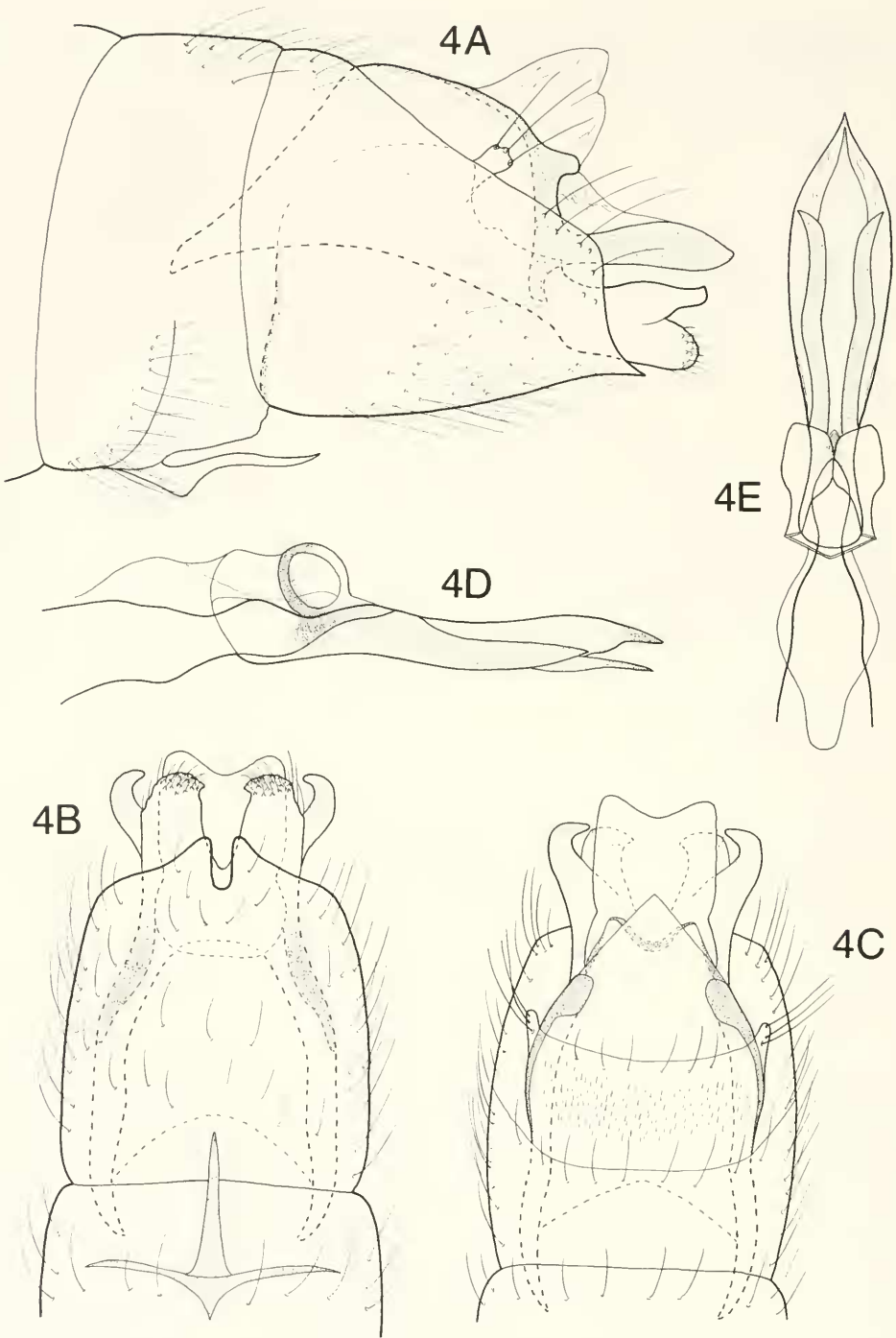


Fig. 4. *Costatrichia lodora*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

lus tubular basally with midlength complex bearing dorsal loop, apically with pair of elongate, thin lateral sclerites and middle plate narrowing to apical point.

Female.—Unknown.

Material examined.—COSTA RICA: Ajuela: Río Pizote, ca 5 km N Dos Rios, 10.948°N, 85.291°W, el. 470 m, 9.iii.1986, Holzenthal and Fasth, 1 ♂ (UMSP); Finca El Ensayo, Cerro Campana, iv.1994, F. Muñoz, 1 ♂ (UMSP); Quebrada Arena, Puesto San Ramón, iv.1994, F. Muñoz, 1 ♂ (UMSP). Guanacaste: Río Tizate, 2 km NE Cañas Dulces, 10.773°N, 85.449°W, el. 275 m, 28.vi.1986, Holzenthal, Heyn, Armitage, 2 ♂ (INBIO); Parque Nacional Guanacaste, El Hacha, Quebrada Alcornoque, 11.009°N, 85.577°W, el. 250 m, 26.vii.1987, Holzenthal, Morse, Clausen, 1 ♂ (UMSP). Heredia: Río Bijagual on road to Magsasay, 10.408°N, 84.076°W, el. 140 m, 12.ii.1986, Holzenthal, Morse, Fasth, 5 ♂ (UMSP). BELIZE: Stan Creek District: Cockscomb Wildlife Preserve, Maya Mountains, Cockscomb-B4, 16.80°N, 88.55°W, el. 200 m, 10–11.v.1990, Adams and Dow, 1 ♂ (CMNH).

Comments.—The specimen of *C. lodora* recorded from San José, Costa Rica, Río General, Pacuare, by Flint (1970) belongs to a new species, *C. flinti*, described below. Flint (1970) noted several differences when the specimen was compared to a paratype of *C. lodora*, but, with insufficient material, these differences were attributed to intra-specific variation.

***Costatrichia flinti*, Holzenthal and Harris, new species**
(Fig. 5)

Costatrichia lodora Flint 1970: 12 [paratype from Río General, Pacuare, Costa Rica], *nec* Mosely 1937.

This species is very similar to *C. lodora* Mosely differing in the shape of the inferior appendages, which have a broad dorsal arm, and in the wide lateral sclerites of the phallus.

Male.—Length 3.3–4.3 mm. Brown in

alcohol. Antenna with 19 segments, scape elongate, basal flagellar segments broad; 3 ocelli. Forewing with elongate costal bulla. Abdominal sternum VII with slender elongate process. Segment VIII narrowing posterolaterally to elongate, narrow spine; in ventral view narrowing posteriorly with small mesal incision. Segment IX narrowing anteriorly, posteriorly with small dorsal process and elongate posteroventral process, laterally with short setose process; in ventral view, posteroventral process generally truncate, slightly emarginate posteriorly. Segment X membranous; in dorsal view triangular posteriorly, broadly fused to segment IX anteriorly. Inferior appendages broadly incised on posterior margin, broad dorsal arm about twice as wide as narrow ventral arm; in ventral view with basomesal shelves which curve inward, distally narrowing to acute apices. Phallus tubular basally, with midlength complex bearing dorsal loop, apically with wide lateral sclerites which narrow to acute distal points, middle plate narrowing to apical point.

Female.—Unknown.

Type material.—Holotype, ♂. COSTA RICA: Puntarenas: Río Singrú, ca 2 km (air) S Finca Helechales, 9.057°N, 83.082°W, el. 720 m, 21.ii.1986, Holzenthal, Morse, Fasth, (NMNH). Paratypes: COSTA RICA: Puntarenas: same data as holotype, 3 ♂ (INBIO), 9 ♂ (UMSP); Quebrada Potrero near Potrero Grande, 5.vii.1992, T. Shepard, 3 ♂ (INBIO), 15 ♂ (UMSP); Río Plantanar, Salitre, 6.5 km E Buenos Aires, el. 455 m, 8–9.vi.1992, F. Muñoz, 2 ♂ (NMNH), 20 ♂ (UMSP). San José: Río General, Pacuare, 1.vii.1967, P. J. Spangler, 1 ♂ (NMNH).

Etymology.—Named for Dr. Oliver S. Flint, Jr. who first recognized the differences between the new species and the closely related *C. lodora*.

***Costatrichia simplex* Flint**
(Figs. 6–7)

Costatrichia simplex Flint 1970: 13.

Males of *Costatrichia simplex* are most similar to *C. spinifera* in the presence of

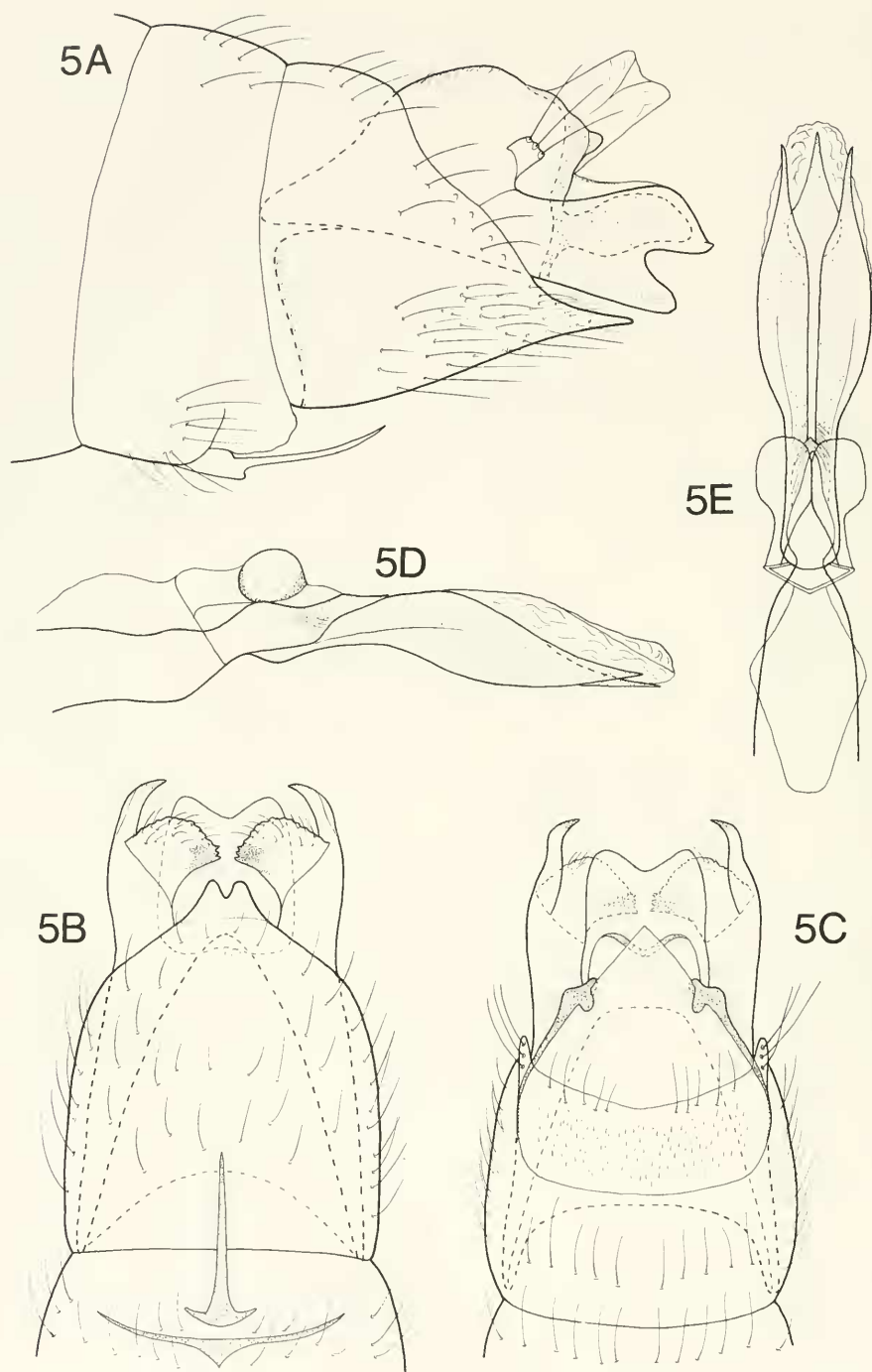


Fig. 5. *Costatrichia flinti*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

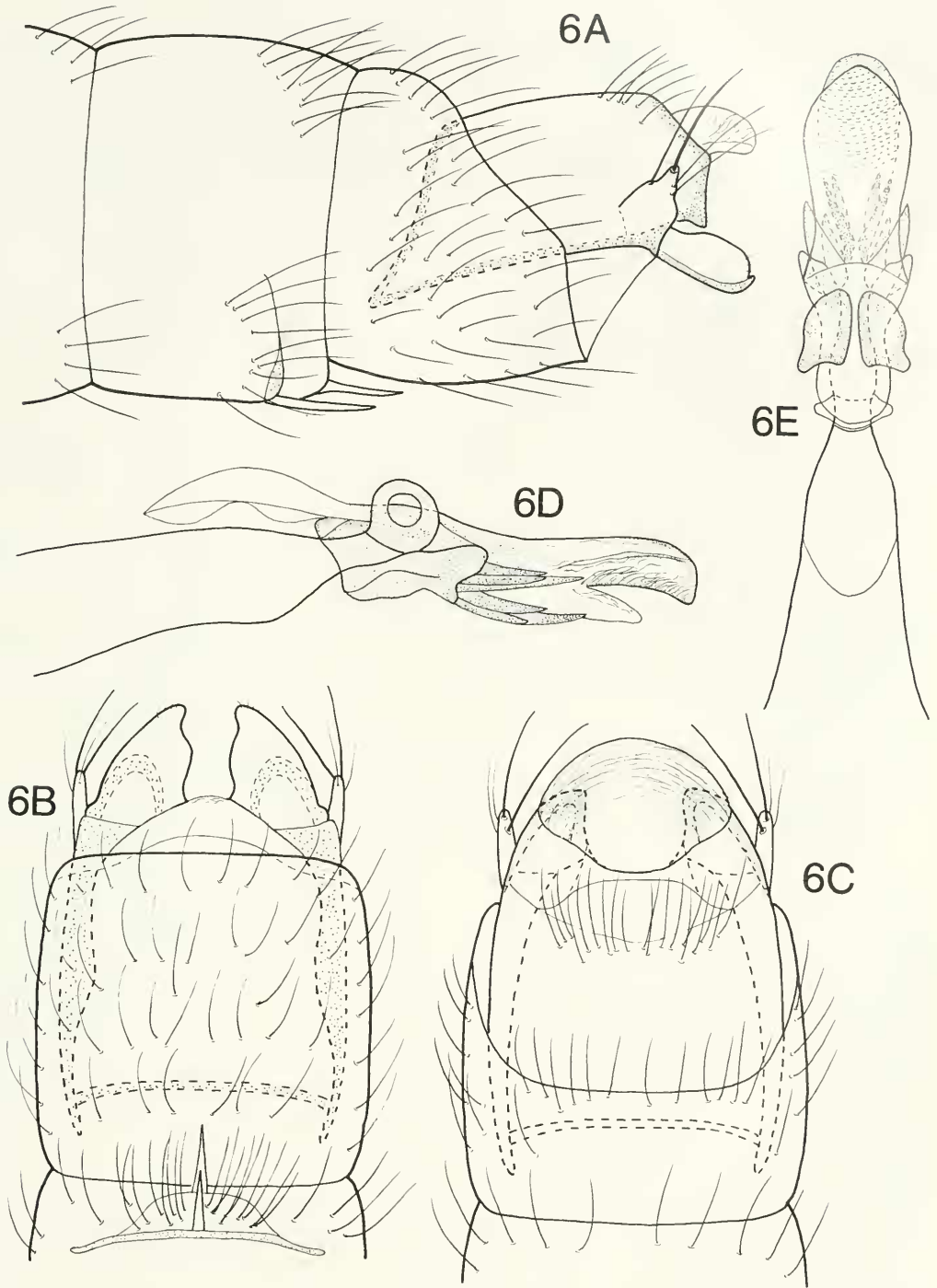


Fig. 6. *Costatrichia simplex*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

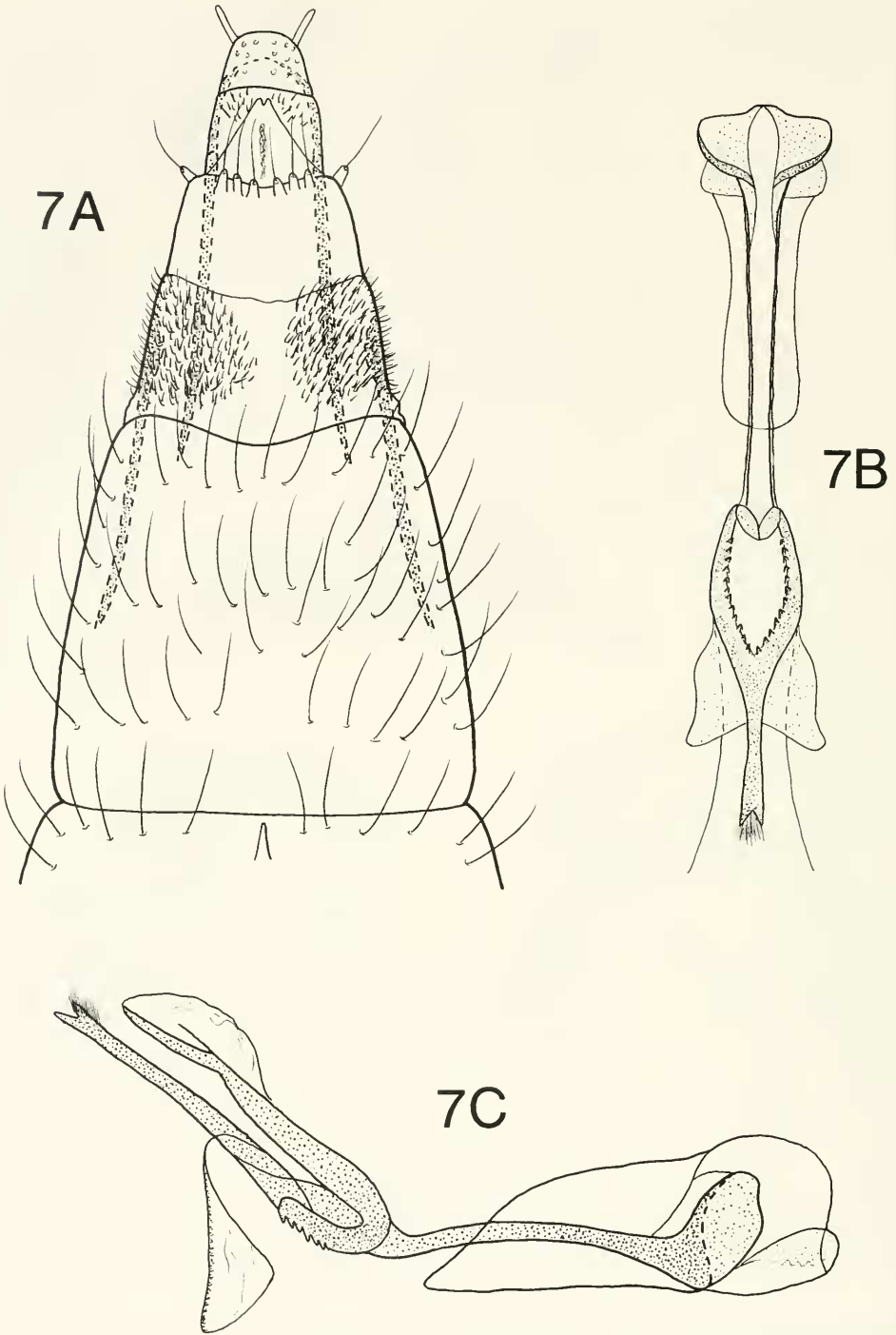


Fig. 7. *Costatrichia simplex*, female genitalia. A, Terminal abdominal segments, ventral. B, Bursa copulatrix, ventral. C, Bursa copulatrix, lateral.

numerous phallic spines. The two species are easily separated by the absence of posterior spines from segment VIII in *C. simplex*. Since females of only a few *Costatrichia* are known, determining affinities is difficult. Females of *C. simplex* differ from those of the *tripartita* group by the narrow posterior portion of the bursa copulatrix and lack of lateral membranous folds. The species has been recorded from Costa Rica, El Salvador, Honduras and Mexico.

Male.—Length 4.2–4.6 mm. Head with whitish hair; antenna with 19 segments, tere-
rete; 3 ocelli. Forewing mostly brown with narrow greenish stripe at midlength, with greenish area subapically and along posterior margin, costal bulla present, but small and inconspicuous. Abdominal sternum VII with pair of short mesal processes. Segment VIII tapering posteroventrally, truncate in ventral view. Segment IX compressed dorsolaterally, narrowing anteroventrally, obliquely truncate posteriorly, bearing a large setose lobe posterolaterally; in ventral view slightly rounded posteriorly. Segment X membranous, a short round lobe in lateral view; in dorsal view rounded posteriorly, broadly fused to segment IX anteriorly. Inferior appendages rectanguloid, ventral margin sclerotized and extending posteriorly as small lobe; in ventral view triangular, with inner margins sinuate. Phallus tubular basally, with midlength complex bearing dorsal loop, apically with cluster of short spines basally, apex with rings of small spicules; in lateral view, spinal cluster ventrolateral in position.

Female.—Length 3.8–4.4 mm. Coloration as in male. Antenna simple, with 19 segments; 3 ocelli. Forewing without costal bulla. Abdominal segment VI with short sternal process. Segment VII nearly square, slightly emarginate on posterior margin. Segment VIII with patches of short spicules, posterior margin with ring of elongate setae; lateral apodemes extending midway through segment VIII. Segment IX with triangular ventral lobe; lateral apodemes extending through segment VIII. Segment X

short, rounded posteriorly bearing pair of apical papillae. Burse copulatrix in ventral aspect thin and elongate; vaginal sclerite lyrelike, with inner margin serrate, connected by thin tube to oval posterior sclerite; in lateral view vaginal sclerite with serrate teeth posteroventrally, bifid anteriorly with cluster of hairs, connected by narrow tube to membranous posterior lobes.

Material examined.—EL SALVADOR: San Salvador, Lake Ilopango near Apulo, 5.viii.1967, Flint and Ortiz, 2 ♂, 3 ♀ paratypes (NMNH). COSTA RICA: Guanacaste: Parque Nacional Santa Rosa, Quebrada San Emilio, 10.862°N, 85.610°W, el. 300 m, 27.vi.1986, Holzenthal, Heyn, Armitage, 1 ♂ (UMSP). NICARAGUA: Solentname, Isla La Venada, 22.ii.1995, F. Collantes, 2 ♂, 1 ♀ (NMNH).

Comments.—Previously recorded from Costa Rica by Flint (1970): Guanacaste: Río Ahogados, 10 miles northwest of Liberia, 25.vii.1965, P. J. Spangler, 1 ♂ (NMNH); Las Canas, 13.vii.1965, 1 ♂ (NMNH).

Costatrichia tripartita Flint
(Figs. 8–9)

Costatrichia tripartita Flint 1970: 13.

Costatrichia tripartita and the two new species which follow, along with the redefined species *C. venezuelensis*, form a distinct group recognizable by the tripartite inferior appendages. *Costatrichia tripartita* is separated from the rest of the group by the deep mesal incision of the posterior margin of the eighth sternum and the internal spine-like process of this segment. As well, the phallus of *C. tripartita* has a pair of short, acute posterolateral spines. The species is known from Panama, but as we have females from Costa Rica which appear to match females collected with males of *C. tripartita* from Panama, we are here recording the species from Costa Rica. This record from San José remains tentative, however, since females of all *Costatrichia* species are not yet associated and species spe-

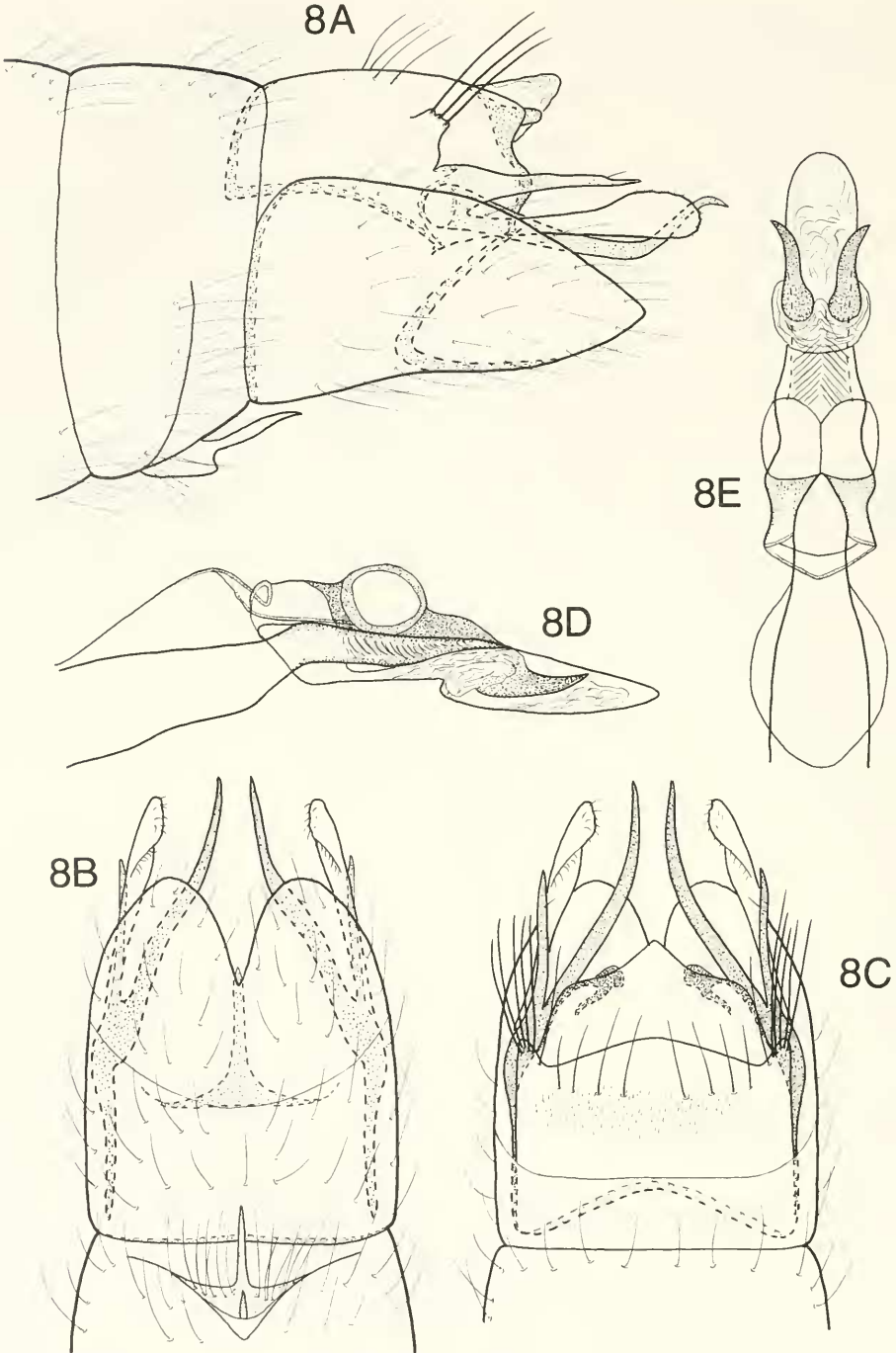


Fig. 8. *Costarichia tripartita*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

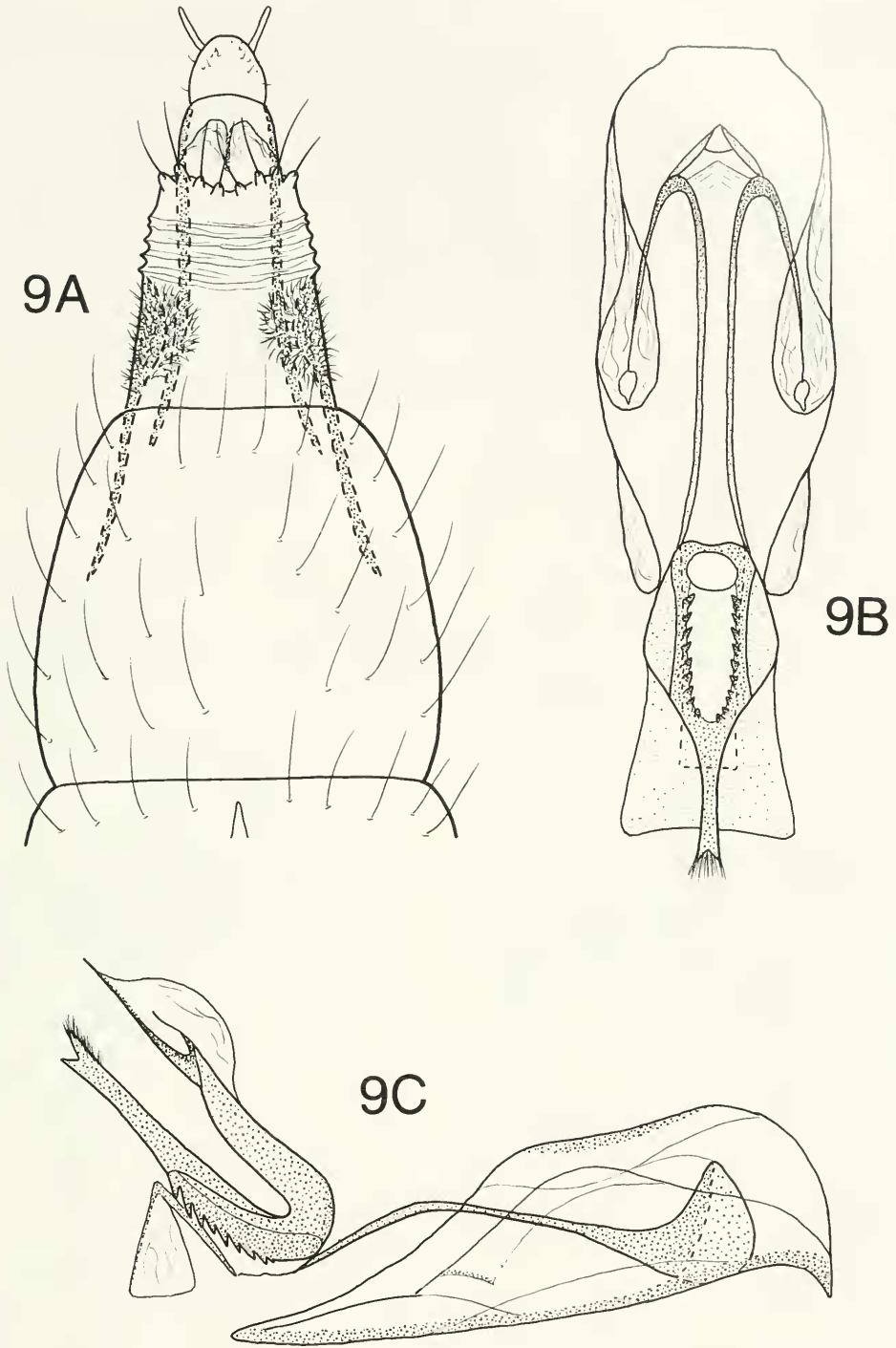


Fig. 9. *Costatrichia tripartita*, female genitalia. A, Terminal abdominal segments, ventral. B, Bursa copulatrix, ventral. C, Bursa copulatrix, lateral.

cific characters are tentative at best. Females of *C. tripartita* differ from the similar *C. carara* and *C. cressae* in the lack of sclerotization in the mesal portion of the bursa copulatrix.

Male.—Length 2.5–3.0 mm. Brown in alcohol. Antenna with 19 segments, scape elongate, basal flagellar segments broad, 3 ocelli. Forewing with elongate costal bulla. Abdominal segment VII narrowing posteriorly to angular apex; in ventral view, deeply incised on posterior margin, internally with mesal spine which connects dorsally with posteroventral margin of segment IX. Segment IX truncate anteriorly and posteriorly, knoblike process posterodorsally, laterally with setal-bearing lobe; rectanguloid in dorsal view. Segment X short and membranous; in dorsal view narrow with mesal extension. Inferior appendages divided into three elongate processes, dorsalmost process thin and elongate, ventralmost process elongate and clublike, mesal process thin, nearly twice as long as dorsal process; in ventral view ventralmost process widening distally to clublike apex, lateral process thin and short, mesal process elongate and curving inward. Phallus wide basally, narrow at midlength complex which bears sclerotized dorsal window and basal loop, laterally with acute posterior spine; in dorsal view with posterior lateral spines, acute apically and slightly diverging.

Female.—Length 2.6–3.1 mm. Brown in alcohol. Antenna simple with 19 segments; 3 ocelli. Forewing without costal bulla. Abdominal sternum VI with short posteromesal process. Segment VII annular. Segment VIII rectangular, with patches of short spicules, posterior margin with ring of elongate setae; lateral apodemes extending through segment VIII. Segment X short, rounded apically, bearing pair of lateral papillae. Bursa copulatrix in ventral view membranous and oval posteriorly, vaginal sclerite rectangular with inner lyrelike structure bearing teeth on inner margin, connected by thin tubes posteriorly; in lateral view vaginal sclerite with serrate teeth posteroven-

trally, bifid anteriorly with cluster of hairs, connected by narrow tube to membranous posterior lobes.

Material examined.—PANAMA: San Blas: Qda. Pingadi, 9 km N Nusagandi, 1–2.iii.1985, Flint and Louton, 8 ♂, 12 ♀ (NMNH); Río Carti Grande, 2 km W Nusagandi, 5.iii.1985, Flint and Louton, 2 ♂ (NMNH). COSTA RICA: San José: Reserva Biológica Carara, Río del Sur, 1.5 km (rd) S Carara, 9.769°N, 84.531°W, 13.iii.1991, el. 160 m, Holzenthal, Muñoz, Huisman, 27 ♀ (UMSP).

***Costatrichia carara*, Holzenthal and Harris, new species**

(Figs. 10–11)

This is the second species of the *tripartita* group, with greatest similarity to *C. venezuelensis*, new status. Both have the eighth abdominal segment tapering to posterior spines and a similar phallic structure. *Costatrichia carara* is separated by a series of small internal spines from the venter of segment VIII and the short dorsalmost process of the inferior appendage.

Male.—Length 2.6–2.8 mm. Brown in alcohol. Antenna with 19 segments, scape elongate, basal flagellar segments broad; 3 ocelli. Forewing with costal bulla. Abdominal sternum VII with elongate posteromesal process. Segment VIII narrowing posterolaterally to thin, elongate spine; in ventral view tapering posteriorly to pair of mesal horns, series of short internal spines laterally and anterior to mesal horns. Segment IX reduced ventrally, dorsolaterally with seta bearing knob. Segment X short and membranous; in dorsal view rounded posteriorly. Inferior appendages tripartite, divided into pair of lateral processes, ventralmost elongate and clublike, dorsalmost very short, and mesal process thin and elongate; in ventral view ventralmost process narrow, curving inward apically, lateral process very short, inner process elongate and sinuate. Phallus wide basally, narrow at midlength complex, which bears sclerotized

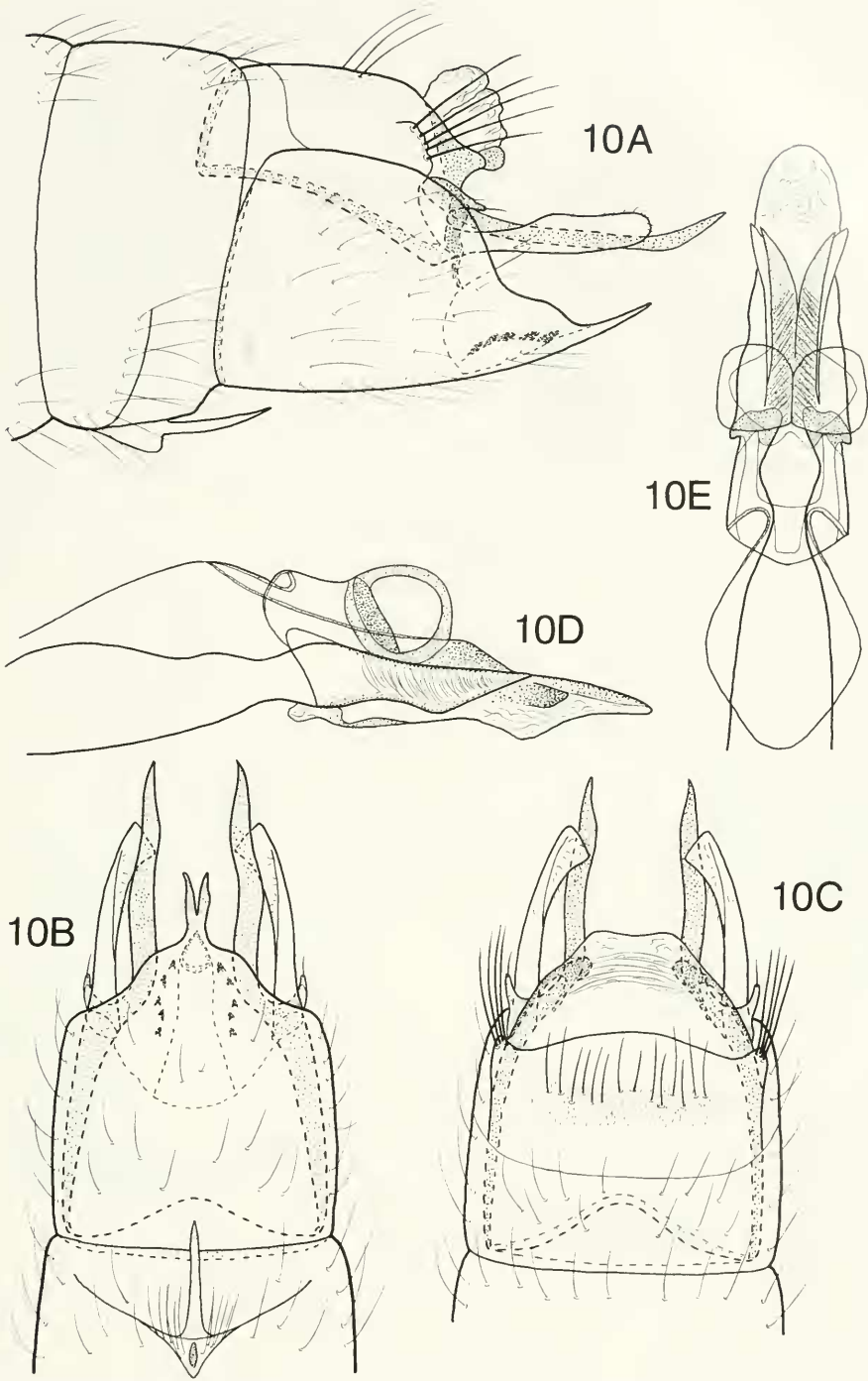


Fig. 10. *Costatrichia carara*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

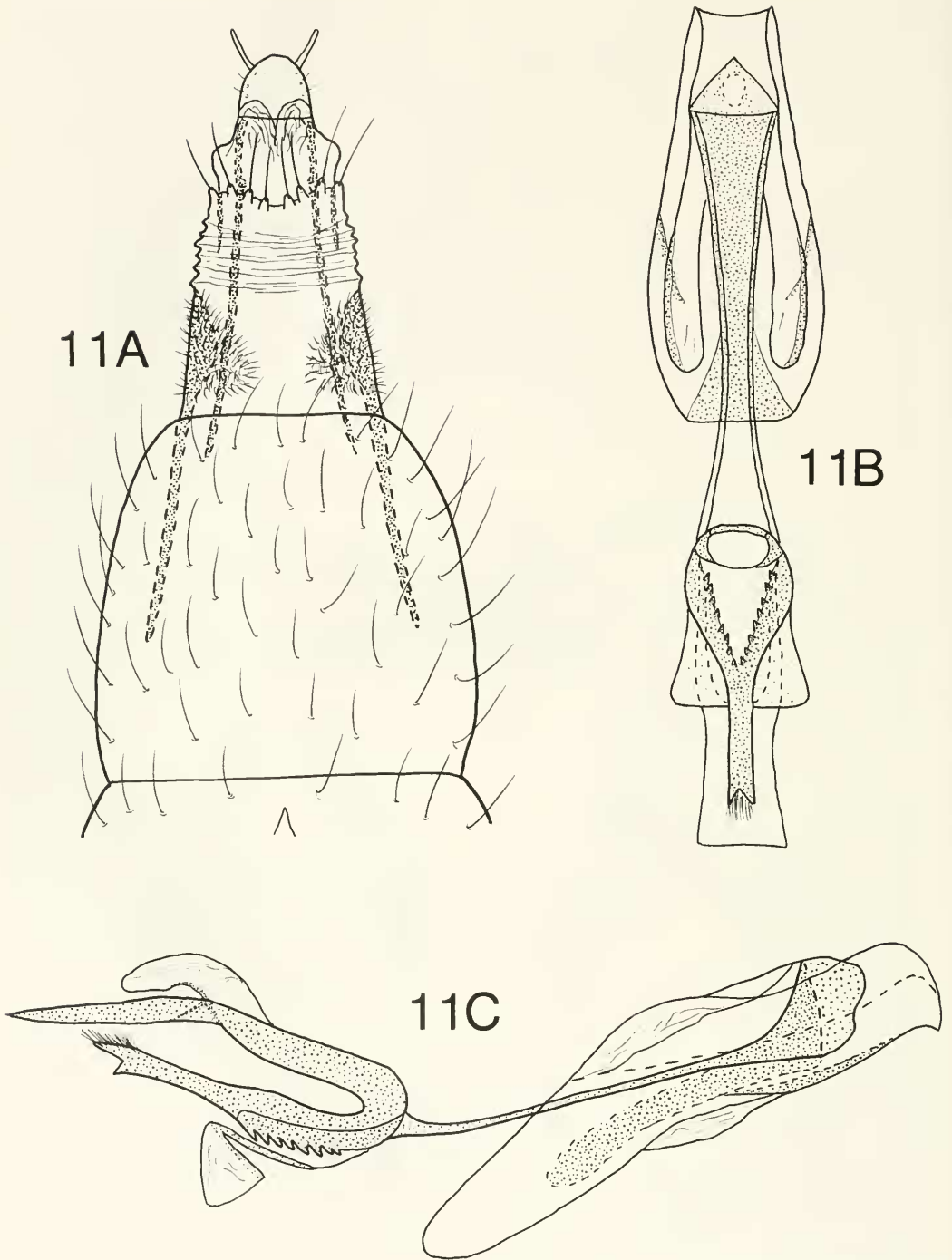


Fig. 11. *Costatrichia carara*, female genitalia. A, Terminal abdominal segments, ventral. B, Bursa copulatrix, ventral. C, Bursa copulatrix, lateral.

dorsal window and basal loop, apically with pair of lateral sclerites.

Female.—Length 2.6–2.8 mm. Brown in alcohol. Antenna simple, terete; 3 ocelli. Forewing without costal bulla. Abdominal segment VI with short sternal process. Segment VII annular. Segment VIII with patches of short spicules, posterior margin with ring of elongate setae; lateral apodemes extending midway through segment VII. Segment IX short with ventral lobes, lateral apodemes extending into segment VII. Segment X short, rounded apically, bearing pair of lateral papillae. Bursa copulatrix in ventral view with oval posterior lobes, rectangular sclerite mesally connected to lyrelike vaginal sclerite by narrow tubes; in lateral view vaginal sclerite with serrate teeth posteroventrally, bifid anteriorly with cluster of hairs, connected by narrow tube to membranous posterior lobes.

Type material.—Holotype, ♂. COSTA RICA: San José: Reserva Biológica Carara, Río del Sur, 1.5 km (rd) S Carara, 9.769°N, 84.531°W, el. 160 m, 13.iii.1991, Holzenthal, Muñoz, Huisman (NMNH). Paratypes: same data as holotype, 1 ♀ (NMNH), 1 ♂, 2 ♀ (UMSP); Reserva Biológica Carara, Quebrada Bonita, 9.775°N, 84.605°W, el. 35 m, 20.v.1990, Holzenthal and Blahnik, 1 ♂ (UMSP).

Etymology.—Named for the Carara Biological Reserve along the south Pacific coast of Costa Rica where the species occurs.

***Costatrichia cressae*, Holzenthal and Harris, new species**
(Figs. 12–13)

This member of the *tripartita* group is most similar to *C. tripartita*. The structure of the phallus is similar in both species, although the posterior lateral processes of *C. tripartita* are acute, rather than rounded as in *C. cressae*. The new species is most readily identified by the presence of a pair of lateral spines on the inner surface of the sternum of segment VIII. The females of

both *C. cressae* and *C. carara* have the mesal portion of the bursa copulatrix sclerotized, but this area in *C. cressae* is much wider than in *C. carara*.

Male.—Length 2.5–3.0 mm. Head with whitish hairs; antenna with 19 segments, scape elongate, basal flagellar segments broad; 3 ocelli. Forewings mostly brown with whitish hairs along major veins and at tips; costal bulla present. Abdominal sternum VII with elongate posteromesal process. Segment VIII narrowing posterolaterally to rounded apex; in ventral view emarginate posteriorly, pair of internal lateral spines posteriorly. Segment IX reduced ventrally, dorsolaterally with seta-bearing knob. Segment X short and membranous; in dorsal view truncate posteriorly. Inferior appendages tripartite, divided into pair of lateral processes, ventralmost elongate and clublike, dorsalmost short, fingerlike, mesal process thin and elongate, upturned distally; in ventral view ventralmost process spatulate distally and converging, lateral process short and fingerlike, mesal process thin, sinuate. Phallus wide basally, narrow at mid-length complex which bears sclerotized dorsal window and basal loop, apically with pair of short lateral sclerites which are rounded posteriorly.

Female.—Length 2.5–3.1 mm. Antenna simple with 19 segments; 3 ocelli. Forewing without costal bulla. Coloration as in male. Abdominal segment VI with short sternal process. Segment VII annular. Segment VIII with patches of short spicules, posterior margin with ring of elongate setae; lateral apodemes extending through segment VII. Segment IX short with ventral lobes, lateral apodemes extending through segment VIII. Segment X short, rounded apically, pair of lateral papillae. Bursa copulatrix in ventral view with oval posterior lobes, large mesal sclerite, connected to lyrelike vaginal sclerite by thin tubes; in lateral view vaginal sclerite with serrate teeth posteroventrally, bifid anteriorly with cluster of hairs, connected by narrow tube to

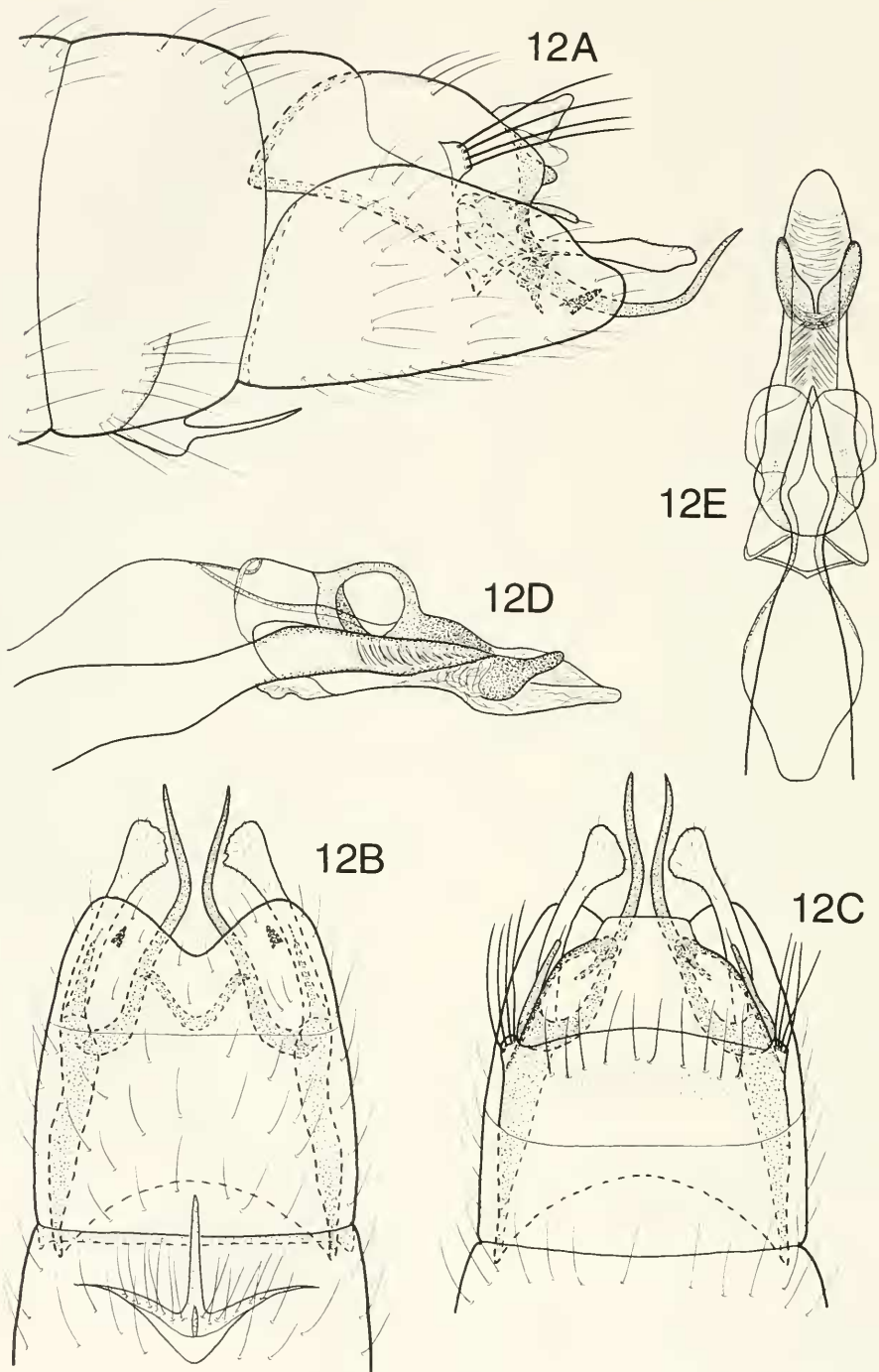


Fig. 12. *Costatrichia cressae*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

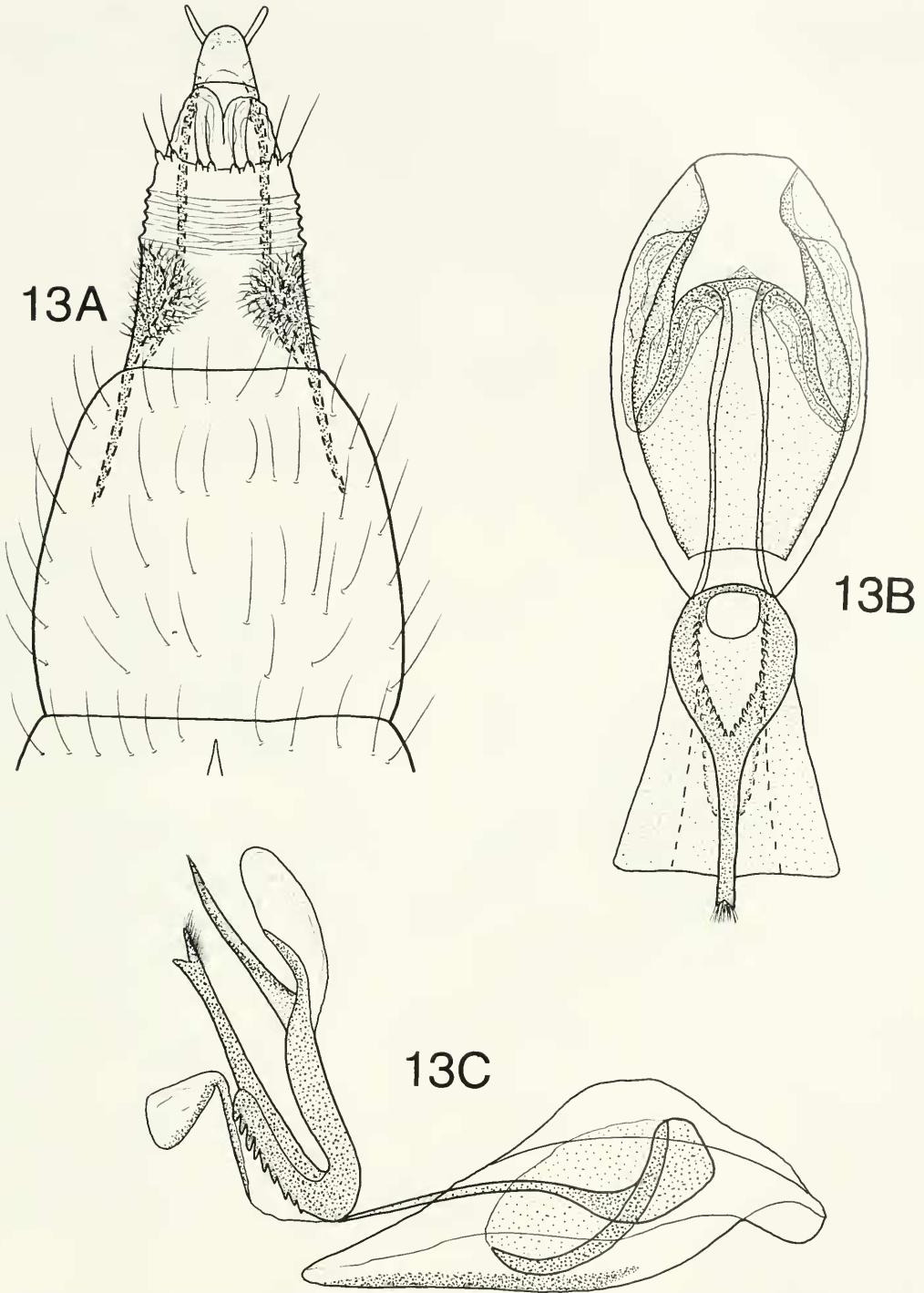


Fig. 13. *Costarichia cressae*, female genitalia. A. Terminal abdominal segments, ventral. B. Bursa copulatrix, ventral. C. Bursa copulatrix, lateral.

membranous posterior lobes which have a transverse sclerite.

Type material.—Holotype, ♂. VENEZUELA: Distrito Federal, Río Camuri Grande, 1 km S Camuri (nucleo U.S.B.), 10.616°N, 66.175°W, el. 30 m, 24.i.1994, Holzenthal, Cressa, Rincón (NMNH). Paratypes: same data as holotype, 1 ♂ (UCV), 4 ♂, 1 ♀ (UMSP); Aragua State, Parque Nat. Henri Pittier, Río La Trilla, 22.5 km N Rancho Grande on road, 17–19.ix.1979, H. Savage, 3 ♂ (NMNH).

Etymology.—Named for Professor Claudia Cressa, Universidad Central de Venezuela, in recognition of her contributions to Neotropical aquatic insect ecology.

Costatrichia venezuelensis Flint,
new status
(Figs. 14–15)

Costatrichia tripartita venezuelensis Flint
1981: 25.

This species was originally described by Flint (1981) as a subspecies of *Costatrichia tripartita*. With the description of several new species in this paper, all similar to *C. tripartita* in the structure of the male genitalia and the discovery of additional material from Costa Rica, the subspecific status of *C. tripartita venezuelensis* was reexamined. The subspecies differs from *C. tripartita* in the appearance of abdominal sternum VIII, which lacks the prominent emargination on the posterior margin. In *C. tripartita venezuelensis* the sternum is truncate or tapering and terminates in a pair of mesal horns. In addition, the phallus of *C. tripartita venezuelensis* has a pair of elongate, flattened lateral plates, rather than the ventral hooks present in *C. tripartita*. On the basis of these differences, *C. tripartita venezuelensis* is elevated to full species status.

Male.—Length 3.6–3.7 mm. Brown in alcohol. Antenna with 19 segments, scape elongate, basal flagellar segments broad. Abdominal sternum VII with elongate, slender process. Segment VIII narrowing posterolaterally to elongate acute process;

in ventral view, tapering or truncate posteriorly with pair of mesal horns. Segment IX narrowing anteriorly, posteriorly with knob-like dorsolateral process. Segment X short and membranous; in dorsal view truncate posteriorly, fused with segment IX anteriorly. Inferior appendages divided into pair of lateral processes, ventralmost elongate and clublike, dorsalmost short and thin, mesal process narrow, elongate; in ventral view, ventralmost process narrow, curving inward apically, lateral process short, inner process elongate and tapering to acute apex. Phallus wide basally, narrow at midlength complex which bears sclerotized dorsal loop, parallel-sided apically with pair of lateral sclerites, short plate mesally.

Female.—Unknown.

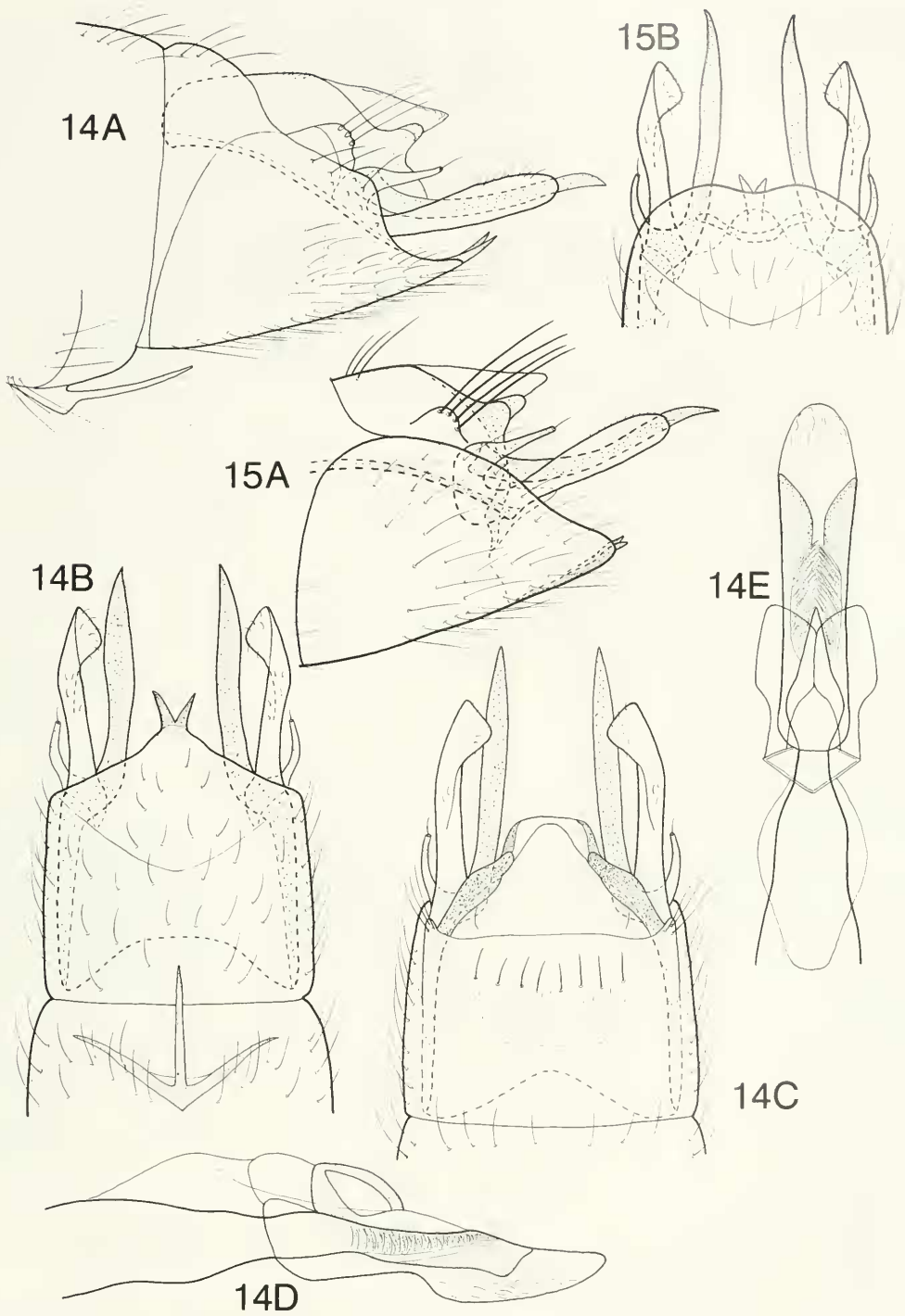
Material examined.—VENEZUELA: Aragua State: Río El Limón fish hatchery, Maracay, 15–16.vii.1975, F. Weibezahn, ♂ holotype, ♂ paratype (NMNH); same, but 10.vii.1973, 1 ♂ (NMNH). COSTA RICA: Limón: Reserva Biología Hitoy-Cerere, Río Cerere, 9.671°N, 83.028°W, el. 90 m, 23–24.iii.1987, Holzenthal, Hamilton, Heyn, 2 ♂ (UMSP).

Comments.—There are some slight differences between the specimens of *C. venezuelensis* from Venezuela and the specimens from Costa Rica, mainly in the appearance of the sternum of segment VIII. In the Venezuela specimens the posterior margin of segment VIII is rounded in lateral view (Fig. 15A), and truncate in ventral view (Fig. 15B), while in the Costa Rica specimens segment VIII is much more tapered posteroventrally (Figs. 14A, B). These differences are interpreted as interspecific variation, as all specimens have in common the posterior mesal horns from the venter of segment VIII (Figs. 14B, 15B).

Costatrichia spinifera Flint
(Figs. 1B, 16)

Costatrichia spinifera Flint 1970: 13.

Costatrichia spinifera is readily recognized by the spinose apical portion of the



Figs. 14–15. *Costatrichia venezuelensis*, male genitalia. 14, specimen from Costa Rica. A. Lateral. B. Ventral. C. Dorsal. D. Phallus, lateral. E. Phallus, dorsal. 15, Paratype from Venezuela. A. Lateral. B. Ventral.

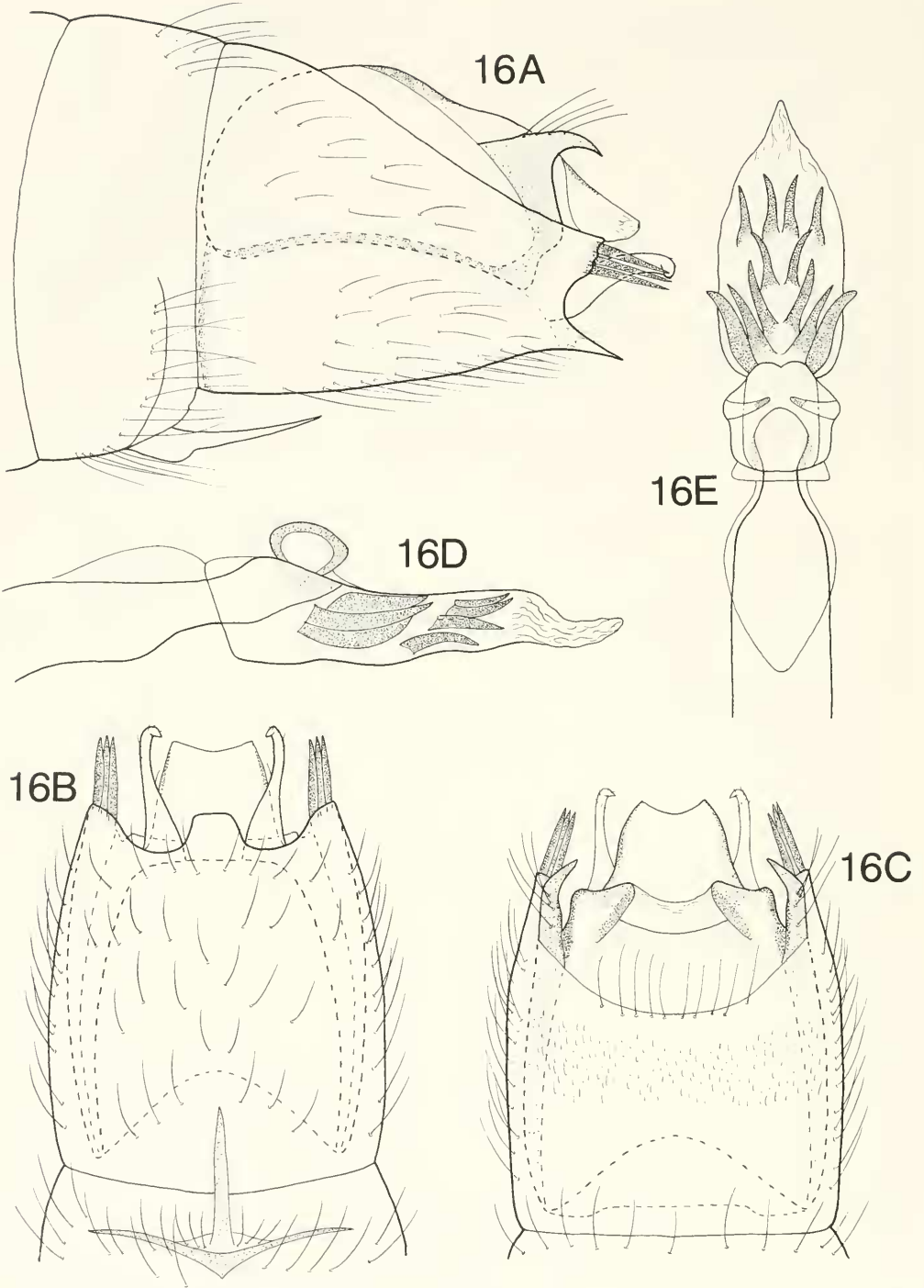


Fig. 16. *Costatrichia spinifera*, male genitalia. A. Lateral. B. Ventral. C. Dorsal. D. Phallus, lateral. E. Phallus, ventral.

phallus. The species appears to be most similar to *C. simplex* from which it differs in the hooklike lateral process from segment IX and the posterolateral spines of segment VIII. The species was previously only recorded from Panama.

Male.—Length 3.7–3.9 mm. Antenna elongate with 19 segments, scape elongate, flagellar segments terete; 3 ocelli. Forewing mostly brown, basal portion and subapically with many greenish-white hairs; without costal bulla. Abdominal sternum VII with elongate, slender process. Segment VIII narrowing posterolaterally to acute ventral point, posterodorsally with truncate extension bearing three stout spines; in ventral view with truncate mesal process posteriorly, three elongate spines on posterolateral margins. Segment IX largely within segment VIII and dorsoventrally compressed, posterolaterally with acute dorsal process; truncate in dorsal view, posteriorly with sclerotized lateral process which curves inward apically. Segment X short and membranous, in dorsal view square in shape with slight mesal incision posteriorly, fused with segment IX anteriorly. Inferior appendages in lateral view short, narrow over length and curving slightly ventrad; in ventral view wide basally, tapering distally, bent inward at apex. Phallus wide basally, narrow at midlength bearing sclerotized dorsal loop, apical portion bearing numerous stout spines posteriorly, anteriorly and mesally.

Female.—Unknown.

Material examined.—COSTA RICA: Puntarenas: Quebrada Potrero near Potrero Grande, 5.vii.1992, T. Shepard, 2 ♂ (UMSP).

***Costatrichia zopilote*, Holzenthal and Harris, new species**
(Figs. 1C, 2B, 17–18)

Costatrichia zopilote is tentatively placed in the *simplex* group based on the simple antenna and absence of a costal bulla on the forewing. The new species is most similar to *C. spinifera* Flint on the basis of the spi-

nose posterolateral extension of segment VIII, a feature also shared with *C. noite* Angrisano. *Costatrichia zopilote* is readily identified by the strongly upturned inferior appendages as seen in lateral view, a feature seen in some species of *Acostatrichia*. However, all species presently placed in *Acostatrichia* possess a costal bulla, a character diagnostic for the genus. Since this new species agrees with many of the characteristics seen in *Costatrichia*, differing only in a few features of the genitalia, we prefer not to establish a new genus and further the taxonomic confusion within the Leucotrichiini. As the Neotropical fauna becomes better known and with the completion of a study underway to reassess the generic limits of Leucotrichiini, it may be necessary to reassign *Costatrichia zopilote* in the future.

Male.—Length 3.2–3.7 mm. Brown in alcohol. Antenna short with 18 segments, scape and first flagellar segment elongate, remaining segments terete; 3 ocelli. Forewing without costal bulla. Abdominal sternum VII with short process. Segment VIII narrow, posterodorsally divided into three fingerlike lobes each bearing a thick, elongate spine, narrowed sharply posteroventrally; in ventral view, deeply incised mesally, lateral processes bearing elongate spines. Segment IX dorsoventrally compressed, posterolaterally with narrow process projecting dorsad; in dorsal view, deeply emarginate anteriorly, posteriorly with thin lateral processes. Segment X short in lateral view; in dorsal view, wide apically, narrowing near base and fused with segment IX, small sclerotized process from ventrolateral margin. Inferior appendages in lateral view tapering distally and bearing elongate setae, sharply curving dorsad; in ventral view fused basally, narrow processes laterally. Phallus tubular with sclerotized dorsal loop below midlength, anterior portion with pair of thin lateral sclerites with acute apices.

Female.—Length 3.5–3.9 mm. Coloration, head and antennal structure, and fore-

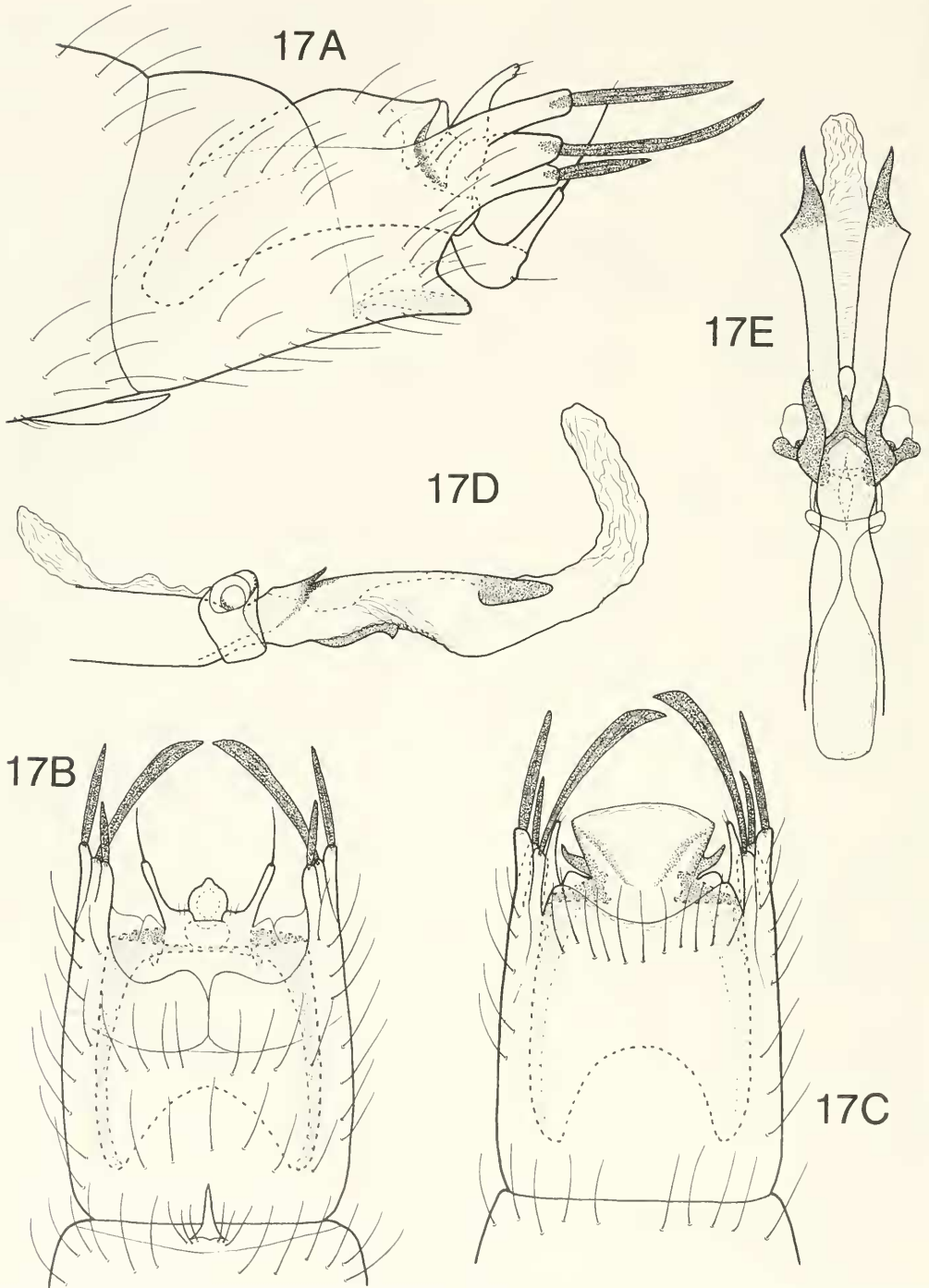


Fig. 17. *Costatrichia zopilote*, male genitalia. A. Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, ventral.

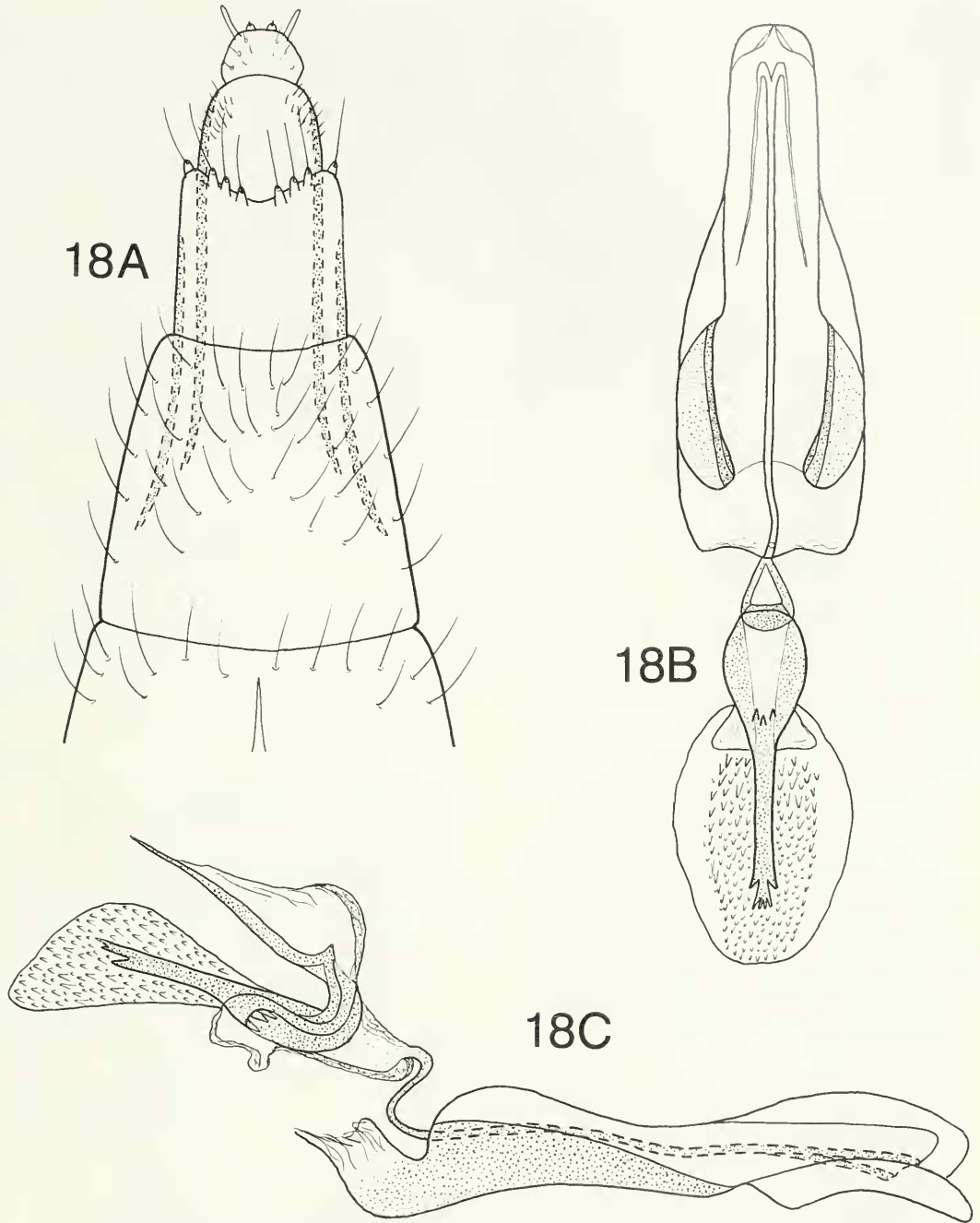


Fig. 18. *Costatrichia zopilote*, female genitalia. A, Terminal abdominal segments, ventral. B, Bursa copulatrix, ventral. C, Bursa copulatrix, lateral.

wings as in male; 3 ocelli. Abdominal segment VI with short sternal process. Segment VII annular. Segment VIII rectangular, posterior margin emarginate with ring of

setae; laterally with pair of apodemes extending midway through segment VII. Segment IX short, rounded posteriorly; laterally with pair of apodemes extending to an-

terior segment VII. Segment X rounded posteriorly, bearing pair of lateral papillae. Bursa copulatrix in ventral view with oblong membranous lobe with pair of lateral sclerites connected by thin tube to lyrelike vaginal sclerite. Vaginal sclerite with several mesal teeth and anterior sac covered with short spicules; in lateral view, serrate teeth posteroventrally, bifid anteriorly attached to spicule covered sac, connected to membranous posterior lobes by thin tube.

Type material.—Holotype, ♂. COSTA RICA: Guanacaste: Parque Nacional Rincón de la Vieja, Quebrada Zopilote, 10.765°N, 85.309°W, el. 785 m, 3.iii.1986, R. Holzenthal (NMNH). Paratypes: COSTA RICA: Guanacaste: same data as holotype, 1 ♂, 1 ♀ (INBIO), 1 ♂, 1 ♀ (NMNH), 3 ♂, 8 ♀ (UMSP); Alajuela: Reserva Forestal San Ramón, Río San Lorencito and tributaries, 10.216°N, 84.607°W, el. 980 m, 30.iii–1.iv. 1987, Holzenthal, Hamilton, Heyn, 5 ♂ (UMSP); Quebrada Arena, Puesto San Ramón, iv.1994, F. Muñoz, 1 ♂ (UMSP).

Etymology.—Named for the type locality, Quebrada Zopilote.

KEY TO MALES OF THE GENUS
COSTATRICHIA

- 1. Abdominal segment VIII laterally bearing elongate spines or fingerlike processes with spines (Figs. 16, 17, 21) 2
 - Abdominal segment VIII without spines from lateral margin (Figs. 4, 10) 4
- 2. Spines from segment VIII originating from truncated posterodorsal extension; phallus with numerous heavy spines (Fig. 16) *C. spinifera*
 - Spines from segment VIII elongate and featherlike, originating from fingerlike lobes; phallus without numerous heavy spines (Figs. 17, 21) 3
- 3. Inferior appendage fused over length; appearing straight in lateral view; spines from segment VIII posteroventral in position (Fig. 21) *C. noite*
 - Inferior appendages only fused to base, narrow and strongly upturned in lateral view; spines from segment VIII posterodorsal in position (Fig. 17) *C. zopilote*
- 4. Inferior appendages divided in lateral view, either into 3 processes or bifid on posterior margin (Figs. 4, 8, 12) 5

- Inferior appendages entire, not divided in lateral view or absent (Figs. 6, 20) 10
- 5. Inferior appendages bifid or emarginate on posterior margin; elongate process from posterolateral margin of segment IX (Figs. 4, 5) 6
 - Inferior appendages divided into 3 processes; no elongate process from posterolateral margin of segment IX (Figs. 12, 14) 7
- 6. Dorsal lobe of inferior appendage narrower than ventral lobe; lateral sclerites of phallus narrow and sinuate (Fig. 4) *C. lodora*
 - Dorsal lobe of inferior appendage wider than ventral lobe; lateral sclerites of phallus wide, tapering to acute apices (Fig. 5) *C. flinti*
- 7. Posteroventral margin of segment VIII narrowing to elongate spine in lateral view, terminating in pair of mesal horns ventrally (Figs. 10, 14) 8
 - Posteroventral margin of segment VIII not narrowing to elongate spine in lateral view, ventrally incised or emarginate posteriorly, but lacking pair of mesal horns (Figs. 8, 12) 9
- 8. Dorsalmost process of inferior appendage very short; venter of segment VIII with series of small internal spines (Fig. 10) *C. carara*
 - Dorsalmost process of inferior appendage elongate; venter of segment VIII without series of small spines (Figs. 14, 15) *C. venezuelensis*
- 9. Venter of segment VIII deeply incised posteriorly, and lacking internal lateral spines; dorsalmost process of inferior appendage over ½ length of mesal process; phallus with posterior lateral processes acute (Fig. 8) *C. tripartita*
 - Venter of segment VIII emarginate with internal lateral spines; dorsalmost process of inferior appendages less than ½ length of mesal process; phallus with posterior lateral processes rounded (Fig. 12) *C. cressae*
- 10. Elongate lateral process from segment IX; subgenital plate distinct; segment VIII laterally tapering to prominent posteroventral spine or process; phallus with spines distally (Figs. 19–20) 11
 - No elongate process from segment IX; subgenital plate absent; segment VIII not tapering laterally to posteroventral process or spine; phallus with basal spines (Fig. 6) *C. simplex*
- 11. Lateral process from segment IX strongly curved downward; segment VIII laterally tapering to seta-bearing, truncate posteroventral process; subgenital plate heavily sclerotized and hooked ventrally; phallus with tridentlike spines distally (Fig. 19) *C. bipartita*

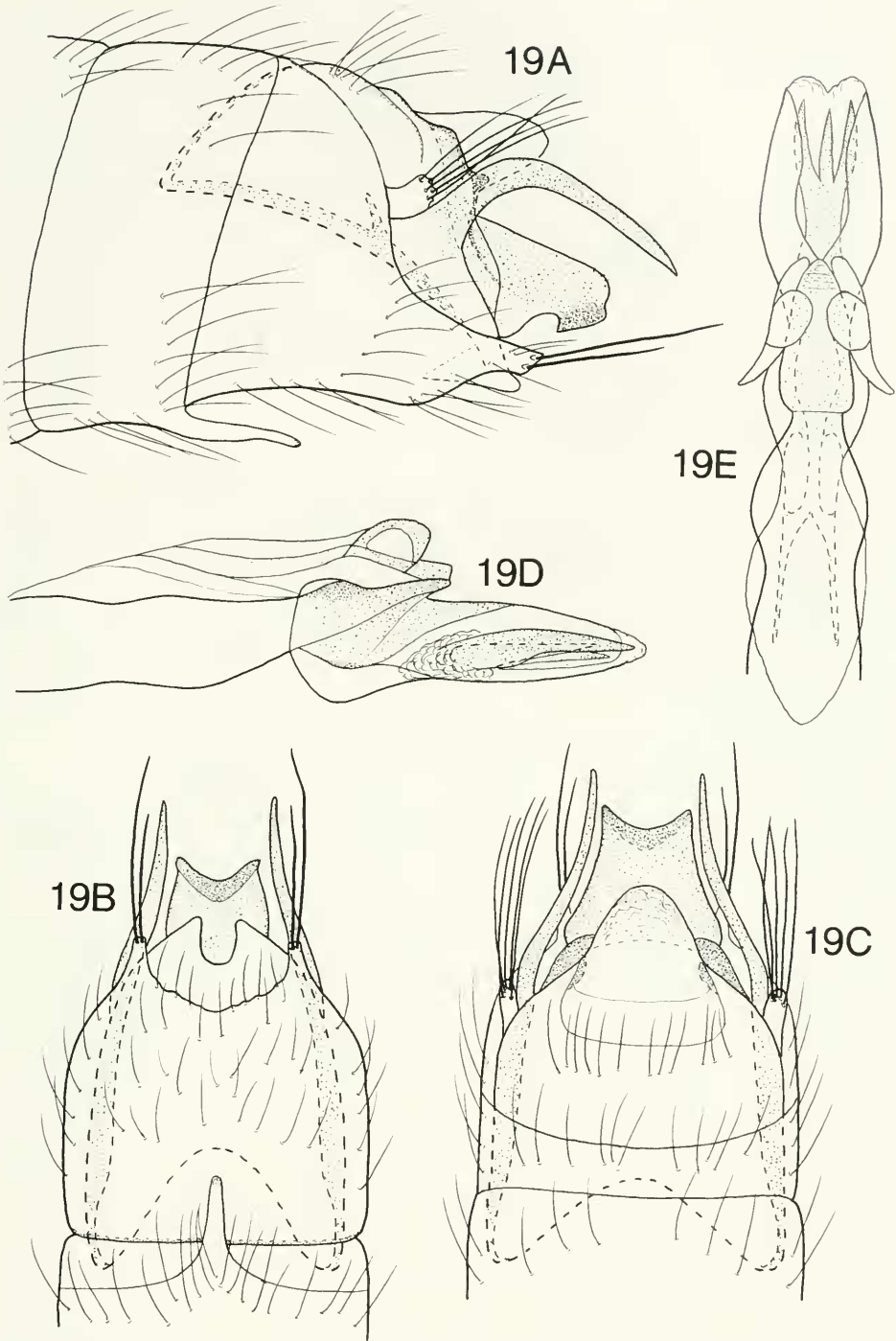


Fig. 19. *Costatrichia bipartita*, male genitalia. A. Lateral. B. Ventral. C. Dorsal. D. Phallus, lateral. E. Phallus, dorsal.

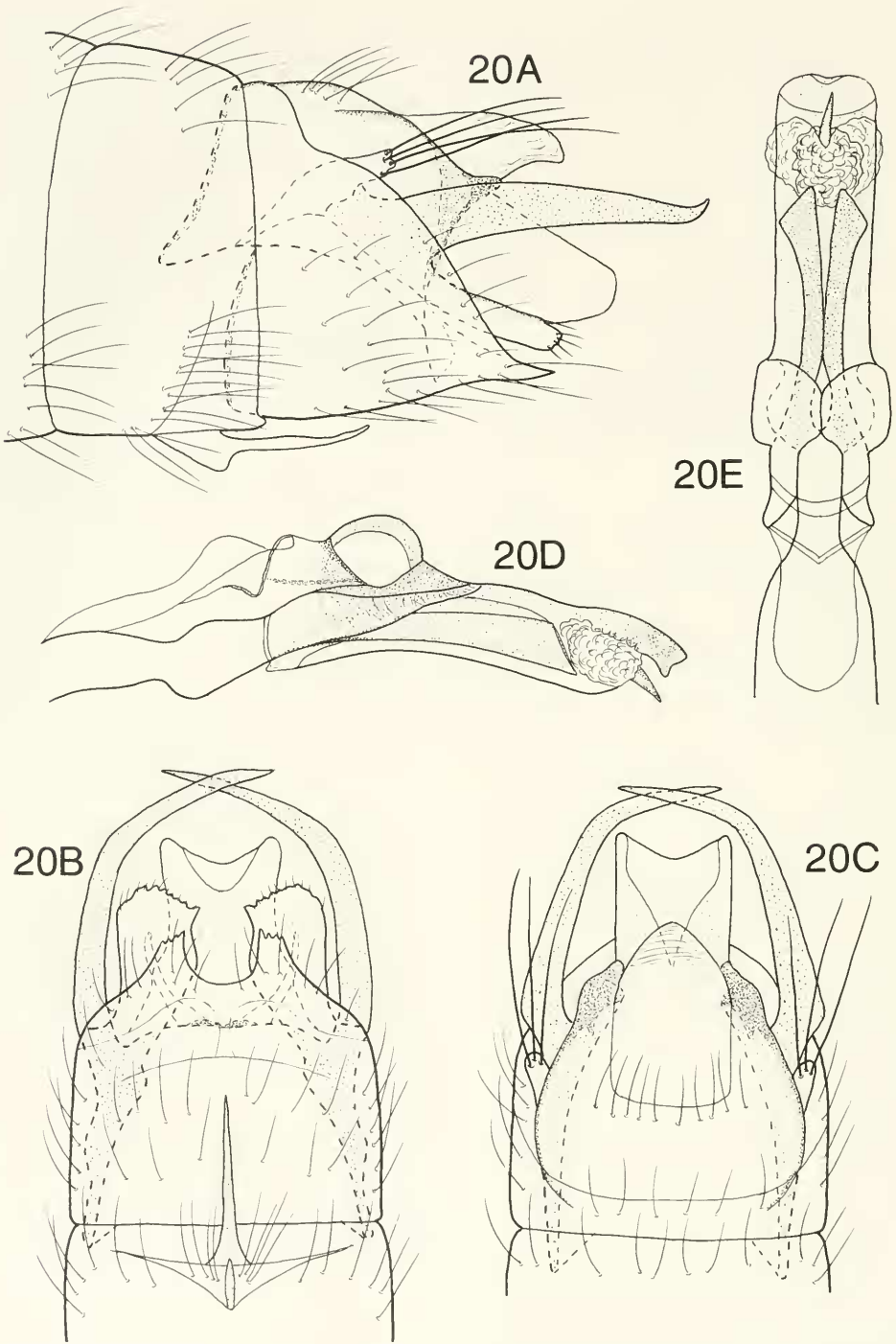


Fig. 20. *Costatrichia panamensis*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

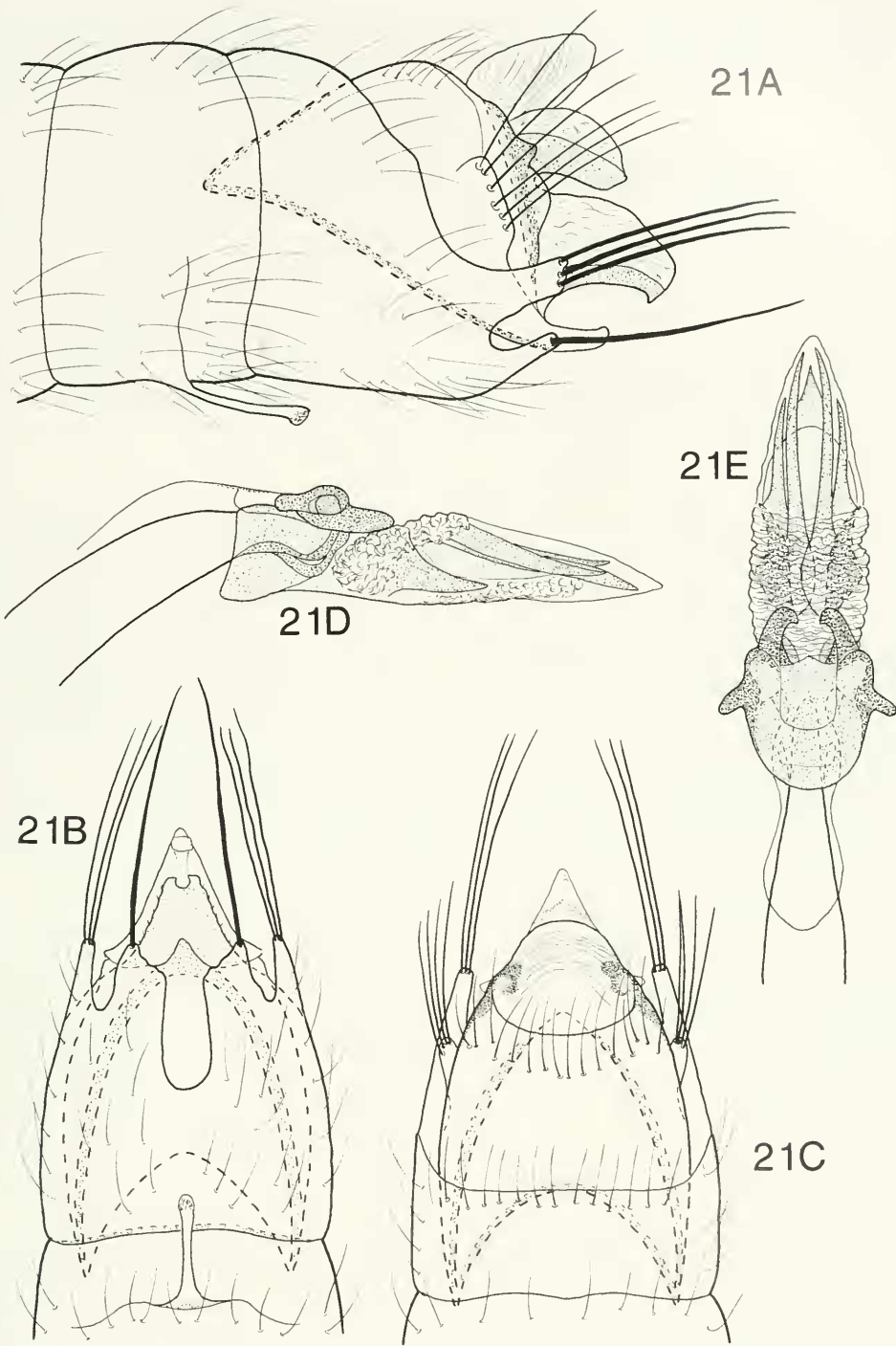


Fig. 21. *Costatrichia noite*, male genitalia. A, Lateral. B, Ventral. C, Dorsal. D, Phallus, lateral. E, Phallus, dorsal.

- Lateral process from segment IX straight; segment VIII tapering to acute posteroventral spine; subgenital plate lobate and unsclerotized; phallus with single distal spine (Fig. 20)
 *C. panamensis*

ACKNOWLEDGMENTS

We thank Dr. Oliver S. Flint, Jr., National Museum of Natural History, for the loan of much of the *Costatrichia* material examined during this study and for his review of the manuscript. Field work in Costa Rica by Holzenthal was supported by National Science Foundation grants BSR-8512368 and BSR-8917684. Subsequent systematics research by Holzenthal and Harris was supported by NSF grant DEB-9400632. Holzenthal's travel to Venezuela was supported by the University of Minnesota Insect Collection and the Universidad Central de Venezuela, Caracas, through Dr. Claudia Cressa. Thanks are also extended to personnel of the Instituto Nacional de Biodiversidad, Costa Rica, Dr. Rodrigo Gámez, director, for their continued support of this research. Paper number 981170025, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota.

LITERATURE CITED

- Angrisano, E. 1995. Contribución al conocimiento de los Trichoptera del Uruguay. II. Familia Hydroptilidae. *Revista Brasileira de Entomologia* 39: 501–516.
- Flint, O. S., Jr. 1967. Studies of Neotropical caddisflies, IV: New species from Mexico and Central America. *Proceedings of the United States National Museum* 123: 1–24.
- . 1970. Studies of Neotropical caddisflies, X: *Leucotrichia* and related genera from North and Central America (Trichoptera: Hydroptilidae). *Smithsonian Contributions to Zoology* 60: 1–64.
- . 1981. Studies of Neotropical caddisflies, XXVIII: The Trichoptera of the Rio Limon Basin, Venezuela. *Smithsonian Contributions to Zoology* 330: 1–61.
- . 1992. Studies of Neotropical caddisflies, XXXVIII: A review of the classification and biology of the Neotropical microcaddisflies, with description of a new genus (Trichoptera: Hydroptilidae: Leucotrichiini), pp. 525–531 *In* Quintero, D. and A. Aiello, eds., *Insects of Panama and Mesoamerica*, Oxford University Press, New York.
- Marshall, J. E. 1979. A review of the genera of the Hydroptilidae (Trichoptera). *Bulletin of the British Museum (Natural History), Entomology Series* 39: 135–239.
- Mosely, M. E. 1937. Mexican Hydroptilidae (Trichoptera). *Transactions of the Royal Entomological Society, London*. 86: 151–190.